AMERICAN MACHINIST

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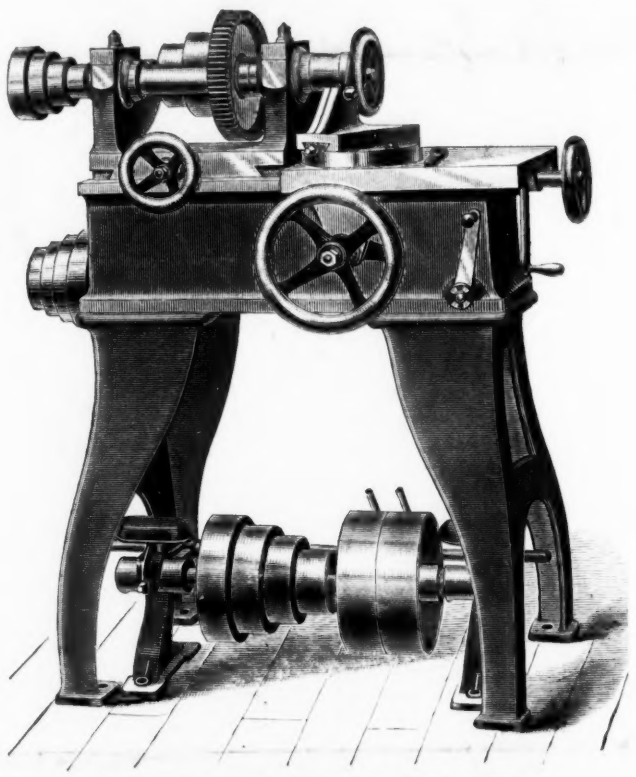
Machine for Turning the Rims of Hand Wheels.

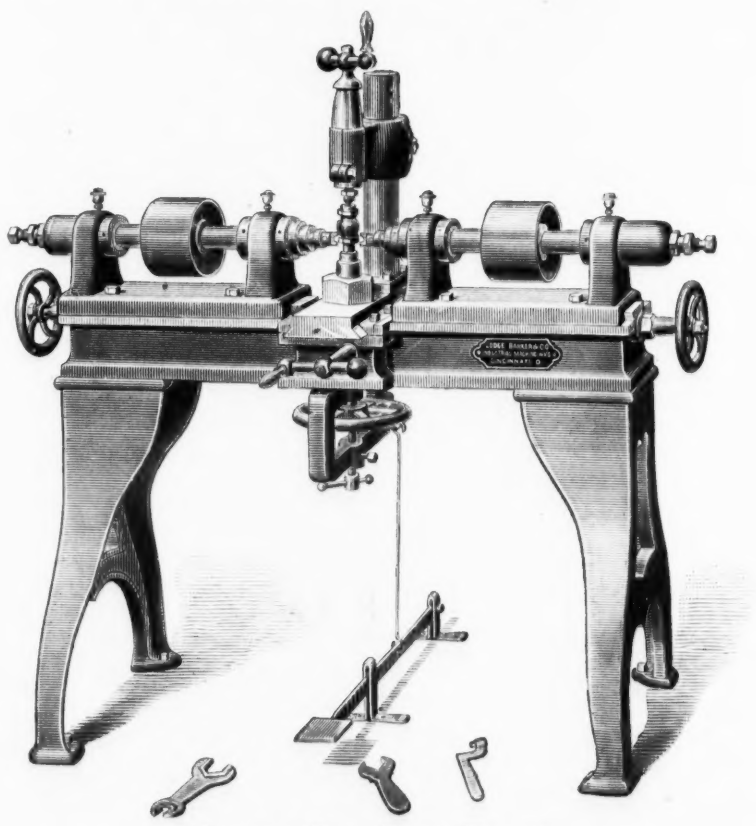
The engraving represents a machine for turning the rims of hand wheels, made by the Pratt & Whitney Company, Hartford, Conn. To those having much of this work to do, this will be found a most convenient and labor-saving tool. The spindle is driven by a cone pulley shaft at the back of the head. This shaft carries a pinion which engages with the gear on the spindle. All necessary adjustments are provided; also automatic feed and stop-motion. The engraving is from a machine for turning the rims of wheels from three to six inches diameter, and is furnished with countershaft and wrenches complete. The weight of this machine is 650 pounds.



MACHINE FOR TURNING RIMS OF HAND WHEELS.

Improved Valve Milling Machine.

The cut herewith presented represents a new valve milling machine, manufactured by Lodge, Barker & Co., Cincinnati, O., which seems to combine the qualities of stiffness and solidity, with facilities for quick and easy handling. The bearings are bronze, and the spindles of forged steel, two inches in diameter. The heads and bearings are made with special appliances for taking up diametrical and end wear. The spindle on which the lower end of the valve rests has a vertical adjustment of three inches. Small discs are made, with the upper part to fit the bottom of valve (not screwed on), and the lower part to fit in upper end of spindle. Similar discs are made to fit the other end of valve. The upper center is then run down and holds the valve firmly in position while being milled. These operations can be performed with great rapidity, and the work is done neat and clean. The index is made for milling four, six, and eight-square. The key is withdrawn from index-wheel by the foot-treadle, shown in engraving, while the index is being turned. The adjustments are so simple that a boy can handle the machine with very little instruction. There are no expensive chucks required, and the whole outfit necessary to be used with this machine costs but a trifle. It is capable of milling from the smallest oil-cup to an hexagon 7″ in diameter. Each machine is furnished with two sets of cutters, two discs, countershaft, wrenches, &c.



IMPROVED VALVE MILLING MACHINE.

Dr. William Thomson, Philadelphia, has been examining the employes of the Pennsylvania Railroad for color blindness. Among 1,383 men examined, he found fifty-five were absolutely color blind. Color blindness is more widespread than what it is generally admitted to be; and singularly enough many of the worst cases do not know they are color blind. There is a chief draughtsman in a prominent machine shop in this city who is absolutely color blind, and none of his friends understood that his color vision was defective till he was some time at work in a drawing office. As he could not distinguish between green and red lines he got blundering with the colors, and the draughtsman he was working under discovered what the trouble was. Men who are color blind have generally excellent vision in other respects.

Groundless Stories about Depression in the Paterson Locomotive Shops.

The most recent stories of depression in the locomotive-building industry at Paterson that have appeared in daily papers prove to be as wide of the mark as were the rumors of depression two months ago. The Rogers Works, which, by reason of a crowding of orders for early delivery, had an extra force of workmen (making about 2,000 in all), discharged some of them temporarily when the rush was over. They now have 1,850 men at work, and the full complement is supposed to be 1,900. Orders have been coming in very well lately, and there is no reason why they should not continue. The Grant Works made a reduction of wages for the purpose, it is said, of making them even with wages paid in other shops. They had lately been running overtime on an order for the Pennsylvania Railroad, and to secure a suitable force had paid extra good rates. The Paterson newspapers represent the feeling as good among the locomotive men, and fears of any further reduction of force very slight.

London Smoke.

BY J. C. HOADLEY.

"Experts in chemistry have estimated that the cost of London's winter smoke and fog is $25,000,000 annually; that is to say, constituents of coal to this value escape unconsumed, and assist in forming the sooty vapor."

The foregoing paragraph cut out of the "Scientific and Useful" column of an evening newspaper, has been drifting about in similar vehicles for months, and may keep on its way for an indefinite period, exciting a vague astonishment in unreflecting minds.

Now twenty-five million dollars, say five million pounds sterling, represents, at ten shillings per ton, say, ten million tons of coal, which would give to every one of the five million inhabitants of London, two tons per annum, and to each family of five persons, ten tons per annum,—a pretty liberal supply, of itself, merely for domestic purposes. The consumption for manufacturing and commerce, steamships and railways, may carry the consumption up to twenty million tons. Much of this coal is burned wastefully, because it is burned in open grates, radiating into the rooms only about 50 per cent. of the heat generated, the remainder, being carried up chimney in a current of warm air, exceeding the coal in weight fifty fold. But the loss from incomplete combustion is very small.

Of the two valuable ingredients of coal for producing heat, carbon and hydrogen, the latter can never escape complete combustion in any ordinary grate or furnace.

The result of its combustion is water, which, at the temperature of the fire is in the form of steam, and at the chimney top, or a very short distance above, watery vapor. A very small quantity of carbon, in the form of an impalpable powder, goes off with the mixture of carbon di-oxide, nitrogen, watery vapor and atmospheric air, called smoke, and gives to this mixture, by diffusion throughout its volume, a dingy color, quite dark, in masses of considerable thickness.

The proportion which this unburned carbon bears to the coal from which it is derived, is however very small, as the following experiment will show. During the week ending August 20, 1881, a stream of gas directly from the flue of a steam boiler fired with bituminous coal producing very black smoke, was drawn by an aspirator through a gas-meter, to measure its volume, and as its pressure and temperature were observed, and as the error of the gas meter was ascertained, the weight of the gas became known. The stream of gas was made to pass through a vessel of water, entering at the bottom through a strainer of muslin, which retained some of the solid matter mechanically, and caused the rest to be diffused and retained by the water, while the gas bubbled up through it quite clear and transparent. The watery vapor, as well as all solid matter carried along with it, was retained with the water in the vessel; only the permanent gases, with doubtless a small quantity of watery vapor escaping in an invisible form. After a sufficient quantity of smoke had been allowed to pass, the residuum in the water and muslin bag was collected, dried and weighed. 100 cubic feet by the gas meter, equal to 108.53 cubic feet corrected for the error of the meter, at 72° F.

weighing 534 grains per cubic foot, yielded 0.49 gramme = 7.57 grains = .001081 lb. and 1 cubic foot, therefore, yielded

.001081 ÷ 108.53 = .00001 lb.

The quantity of coal burned during the week was 12,890 lbs.; the mean quantity of flue gas per pound of coal during the same week was 25.23 lbs., and the total quantity of flue gas generated during the week, was

25.23 × 12890 = 325215 lbs.

The volume of this gas at 72°F. was

325215 ÷ 0.0762857 = 4,263,119 c. ft.

(the weight of 1 cubic foot being

$$\frac{534}{7000} = .0762857 \text{ lbs.}$$

Since each cubic foot of smoke contained .00001 lb. of solid water, the whole quantity of such matter carried off from 12890 lbs. of coal, was

4,263,119 X .00001 = 42.63 lbs.

and the ratio, was

42.63 ÷ 12890 = .0033 = 0.33 per cent.

No analysis was made of the solid residuum, but its gray color indicated that not more than one-half was carbon. It would therefore appear that not far from one-sixth of one per cent. of the carbon of the coal consumed escaped, unburned. Applying this ratio to the assumed quantity of coal consumed per annum in London, twenty million tons, we have:

20,000,000 X .0166 = 33333 tons,

and at $2.50 per ton, $83,333—an important sum, truly, but only one three-hundredth part of the sum given in the paragraph which served as our text. Any additional waste—and there is a little—is necessarily in the form of invisible carbon monoxide, which cannot in the least "assist in forming the sooty vapor." This is rather worse than the usual exaggeration on the subject of coal combustion and waste, by boiler-doctors, inventors and schemers, who generally content themselves with from ten to thirty fold expansion of the losses they propose to remedy.

Geometry in the Foundry.

BY THOS. D. WEST.

In nearly all trades some knowledge of geometry is required. For the moulder no one seems to have written up that which is applicable to his trade. Some may wonder what moulders want geometry for, and think, if we understand the use of shovel and rammer, it is all we need. This, in many cases, may be true. But often a knowledge of geometry can be turned to as good an account in our trade as in others. It is as essential that many moulders should understand geometry as it is that pattern-makers should do so. The way it now is the pattern-maker generally does our geometry for us; and we, through our ignorance, are forced to submit to other tradesmen, to our own detriment. In green sand, as well as in loam work, moulders are often obliged to call the pattern-maker to explain, or to mark out work that requires geometrical knowledge. Moulds are often made requiring the dividing of circles, or marking off of square, oblong and other shapes; locating of flanges, lugs or sections of patterns, etc. The lack of geometrical knowledge is often woful. I remember a case where a moulder was sent for the radius to describe a circle, and returned with a pattern segment. When questioned, he said the pattern-maker was absent, and as the segment was upon his bench he thought that was the thing wanted.

To describe a circle is a simple affair. To divide one into any number of equal parts is where a knowledge of geometry is found useful. The number of parts into which a circle can be most readily divided is six, because the distance from the center of any circle to its circumference, as *B*, *A*, Fig. 2, will divide the circumference into six equal parts, *F*, *D*, *A*, *P*, *E* and *S*. To divide the circumference into three, take out every other one of the six points. To divide it into twelve equally, divide each of the six parts. To divide it into four parts, describe a line through the center, as *K*, *O*, Fig. 3. From the points where *X*, *O* intersect the circumference, with trammels or dividers set at more than two-thirds the diameter, describe arcs cutting each other, as at *N*. A line drawn from *N* through the center divides the circle into four parts. For eight parts, bisect each of the four. Many divide the circle into four parts by the use of a square, instead of by describing the arcs, as at *N*.

The division of circles into odd, or even equal, sections can be done as follows: At *H* and *R*, Fig. 4, the radius, or one-sixth of the circumference, is set off. This radius is then divided, by trial, into the number of sections required. With the trammels or dividers set to the chord of six of the parts, space off the circumference. This will divide the circumference into the same number of sections as in the radius. Should it fail to do so, the fault is yours. It must be remembered that to *exactly* divide the circumference requires very fine manipulation. There are but few men that can go around the circle twice, and come out exactly alike.

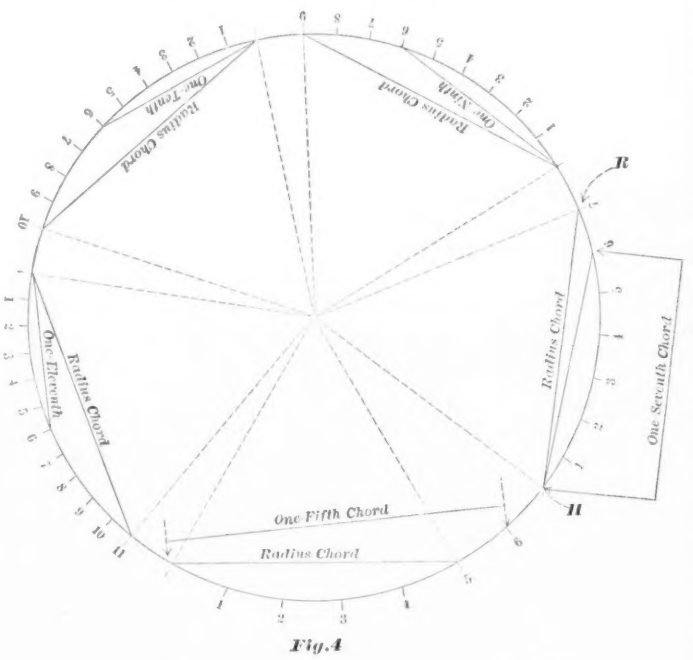


Fig. 4

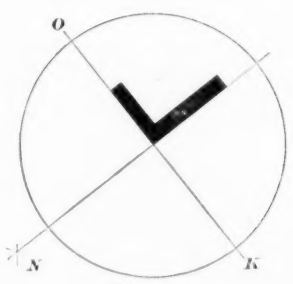


Fig. 3

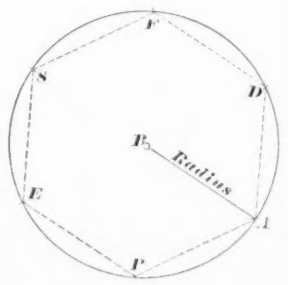
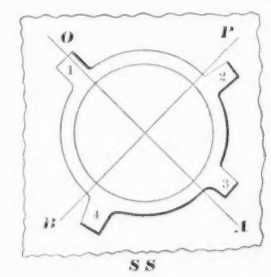
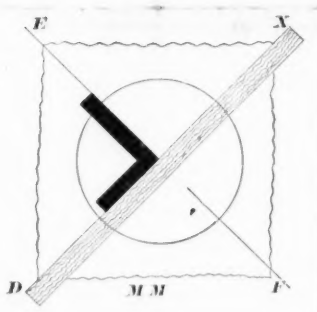


Fig. 2



S S



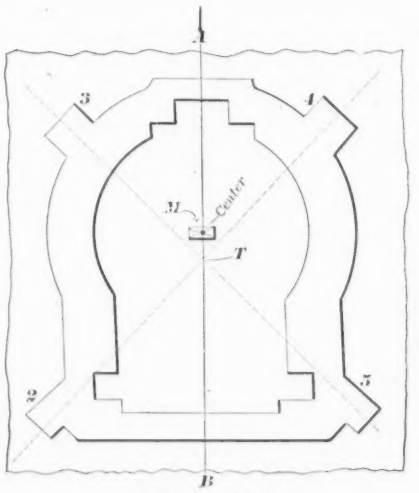
M M

One-tenth, one-ninth, one-eighth and one-seventh are simply shown to further illustrate the rule. To obtain one-fifth, the radius is divided into five, and, in order to have the six points, one is added to the radius length, as shown. If by this rule the circle was to be divided into four equal sections, the radius chord would be divided into four sections, and, in order to have the six points, two would be added to the length.

For the divisions of circumference into small parts for the purpose of gear-making, etc., rules implying mathematical calculations are required. The plan here given is such as requires no figures, and can often be used by the moulder to good advantage.

In loam moulding plates are required, that in the hands of some moulders will be made without any visible shape of pattern, while others will require almost a full pattern. There are some loam moulders who can make any number of loam plates and rings entirely from the drawings, and not have a mistake in the lot. To be able to lay out a lot of rings and plates, and have them all come right, requires one to understand the reading of drawings, and a few of the elementary rules of geometry, besides sound judgment.

In marking out upon a sand-bed for any ring or plate having irregular shapes, a center line to work from is required, the same as the draughtsman requires in making a drawing. The cut showing a cylinder plate ring will to the novice convey ideas of laying out that may be useful. The bed being made, the first thing done is to drive a center stake, *M*. In this stake is made a small hole, for the dividers or trammels' point. Crossing this center is marked the center line, *A B*. From this line all right-angle lines and measurements are taken. The circular lines being described, the next to follow is marking and locating the lifting handles, 2, 3, 4 and 5. This often requires careful consideration, that they may be placed in the best position to insure or assist the mould being balanced when hoisted up. In locating lifting handles upon square or round plates, they should, as a general thing, be set square with each other. This will be better understood by referring to the cuts, *M M* and *S S*. In *M M* the square and straight edge seen show the manner of squaring off the bed. The straight edge having its edge over the center, the square is set against it, so as to have it lay at right angles from the center; the lines *D*, *E* and *X* are then described, after which the square and straight edge are removed. The straight edge then being laid alongside of the line *E*, the line is carried through to *F*, thereby squaring off the bed.



Cylinder Plate

In the cut, *S S*, the lines *O*, *P*, *A* and *B* describe the square, while the handles 1, 2, 3 and 4 are out of square. The objection to such random dividing of handles is, they will not come plumb under the lifting cross which is usually made square. Also, handles thus placed upon rings, square or round plates, do not make them uniformly carry their load, thereby giving them a chance to spring, and cause the mould to crack. Some may say that they are often compelled to locate handles out of square to make them balance their load. This may be true in some cases, but, when possible, instead of distorting the square, the center point should be moved to where the best judgment points out will be the mould's balancing center.

To illustrate this idea, instead of having the cylinder plate shown squared from the center, square it from *T*. This, while it does not distort the square of the handles, will bring the balancing point wherever desired.

Sometimes plates are required oblong. This does not always call for the handles to be set oblong. If necessary, handles can be set square upon an oblong plate as well as upon a round or square one, as long as the lines are at right angles to each other; coming towards their center does not alter the square. Of course, it is not here advocated to set handles square at the sacrifice of oblong plates being sprung when their load comes upon them. The thing is to understand what is best, and then be able to do it.

Improperly-placed handles have been the cause of much trouble in adjusting and balancing moulds, and have caused many moulds to crack. This fault, and other faults, are not so much from carelessness as from the want of a little geometrical knowledge. There are but few loam moulders who, from a drawing, are able to order their sweeps, &c., and make the jobs required. Our trade demands something higher than loam daubing and shoveling sand, and he that tries for the highest cannot but find himself benefited.

One Way to Economize.

"My dear," exclaimed Mrs. Jay Gould, picking up a new diamond paper-weight, this will never do; we must economize."

"Well, shall we give up the steam yacht?" exclaimed Mr. Gould, lighting a cigar with a $50 bill.

"Oh, no; we can't spare that."

"How about sealskin sacques?"

"I have only nineteen now, and none of them look fit to be seen."

"Why not stop buying diamonds?"

"Mercy! What are you thinking of? The doctor says I need exercise, and how can I get exercise if I don't go shopping?"

"Very true; but, as you say, something must be done. Ah, I have it! I will just order another reduction of wages!"—*Virginia City (Nev.) Chronicle.*

The "Philadelphia," the first steam fire engine built in the city whose name it bears, and one of the first of that kind in the country, has been taken to Boston as a witness in a patent law suit. A patentee of a relief valve is suing parties in Boston for infringing his patent, and the "Philadelphia" is to be used as evidence that the relief valve was an old device when patented. There are a good many similar cases round the country where patents have been got out on old inventions.

The *Winston Sentinel* is laboring zealously to start up a manufacturing boom in North Carolina. It points to numerous classes of raw material raised within its borders and transported long distances to be manufactured and returned at high prices for home consumption. A North Carolina town in the heart of one of the finest mineral districts in America sends to Pennsylvania for coal and iron, when nothing but labor, capital and enterprise are needed to make that same town a second Pittsburgh. The *Sentinel* is not satisfied with this condition of affairs, and thinks men ought to do something for the State where nature has been so lavish with her gifts.

New 60-Inch Surfacing Machine.

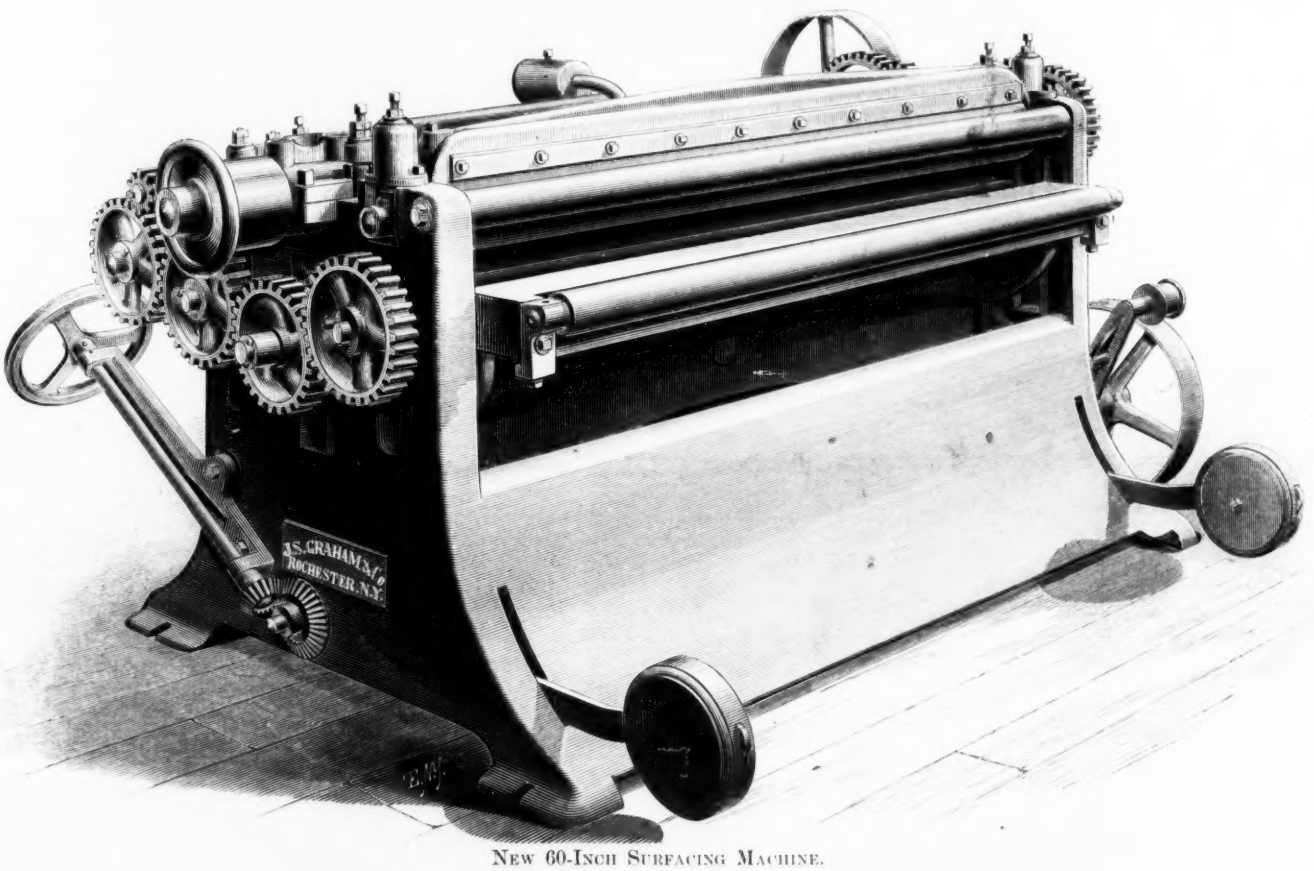
The engraving presented with this represents a new surfacing machine, designed for use where extra wide smooth surfacing is required, such as planing the sounding boards of pianos, and for other work in piano and organ factories and otherwheres. This is a heavy and powerful machine of the "pony" type, and in its construction has several novel features.

The cylinder, which is of steel, carries four knives, each 60″ in length, and runs on tool steel journals 2¼″ diameter by 9″ long, the boxes being lined with genuine babbitt metal. Pressure bars on each side within ⅜″ of the knives prevent the tearing or slivering of cross-grained or knotty lumber. In order that the pressure bar on the side next the rough lumber may, in yielding to the uneven surfaces, always preserve its position with reference to the cylinder, it swings on a circle concentric with that of the cylinder, and is provided with a pivoted shoe that tips so as preserve a constant pressure on the board until it has passed to the knives. The pressure bar on the finishing side is provided with a yielding adjustment, for wet or resinous lumber. The lumber being held down by pressure in such a way as to leave a space of only 3″ from one pressure bar to the other, stuff as short as 5″ in length can be readily planed, as well as knotty and cross-grained stock.

The rolls, of which there are four, are driven by a strong train of gearing. The roll boxes are of gun metal, and pinions, studs, raising screw, etc., of steel.

One of the novel features of construction referred to is an arrangement that enables the operator to plane stock tapering or thinner at one edge than the other. This is important in many instances, one of which is the sounding boards of pianos, which are usually finished ⅜″ thick at one edge, and $\frac{3}{16}$″ at the other. To provide for planing taper work, a trussed box frame is raised or lowered by means of a large hand wheel at the side of the machine. Upon this frame is the bed or platen on which the lower rolls are fitted. This bed is carefully fitted over the frame, and pivoted at one end. At the other end, below the truss, is a hand wheel and screw by means of which one end or side of the bed is raised for planing taper. By the means of a hand wheel on the other side, the bed is secured in any desired position. This adjustable feature would also appear to be valuable on a machine of this extreme width, for getting an equal thickness of stuff, should the knives when set or after sharpening be found not parallel with the bed.

The finished weight of this machine is 6,000 lbs. It is built by J. S. Graham & Co., Rochester, N. Y.



NEW 60-INCH SURFACING MACHINE.

A revolving guard for a locomotive cow-catcher is one of the latest devices that has received the protection of the U. S. patent laws. It is a very ingenious machine, and no doubt has cost the inventor much thought and patient labor. Had he had any practical experience in railroad matters, he would have thrown the drawings in the fire after they were finished, and turned his attention to car couplers or some equally remunerative branch of invention.

Personal Recollections.

BY S. W. GOODYEAR.

THE SEWING MACHINE.

So much ingenuity had been displayed in designing the sewing machine, to which I have referred in former articles, as to furnish ground for a patent, or to make it unlike any other machine heretofore built. Other vertical needle bars, working in fixed bearings, affording the advantages supposably derived from the use of straight needles in place of curved ones, had been used, their reciprocating motion being given them by the action of a crank on a continuously-revolving shaft. In this machine, however, the needle bar was connected with, and operated by, a rock-shaft, with crank and connection, the difference between it and others before it being that the shaft which operated the needle bar, in combination with a crank and connection, did not revolve. Of course, a shaft, which was provided with crank and connection, did revolve to give the rocking-shaft its motion, and it was hinted that this was simply a device to "get around" the combinations of prior inventors. The looper consisted of a curved finger, a part of and projecting from a slotted piece, which was attached to the end of a horizontal lever by a stud screw passing through both vertically, and forming the pivot on which the looper worked with a slight swivelling motion communicated by a connection, one end of which was attached to the looper and the other end to a raised seat for the purpose on the under side of the bed. Motion was communicated to the lever which operated the looper by a cam. Originally the cam worked against a side of the opposite end of the lever from that to which the looper was attached, the lever being held up to the periphery of the cam by a spring. The lever was pivoted by means of a hole through it, and a stud screw at a point in its length not far from half way from the driving cam to the looper. Later on it had been thought desirable to change to a covered or grooved cam, dispensing with the spring and making a positive motion, which had been done, the end of the lever being turned down to suitable size, and having fitted to it a sheave or friction roll to run in the groove in the cam. This plan was successful, except that, as the axis of the cutter in cutting the groove was parallel with the axis on which the cam revolved, the sheaves had to be made sufficiently crowning to accommodate themselves to the many positions out of line with the axis of the shaft to which they were brought at each revolution, and left but a very slight amount of contact surface between the sheave and the walls of the groove, in consequence of which the sheave and groove together were often worn away by a few days' use sufficiently to cause considerable lost motion.

CAM-CUTTING MACHINE.

To overcome this difficulty, a special cam-cutting machine was built, by the use of which the groove was cut with its walls parallel at all points with the axis of the sheave, permitting the sheave to be made a snug running fit in the groove for the entire breadth of its face. To accomplish this, the cam was mounted for cutting on the end of a shaft, which had its bearings and revolved in a frame, which was attached to a bed-piece on the bed of the machine by a gibbed swivelling attachment, the axis being vertical. With the cam placed on this shaft at the proper distance from the axis on which the frame was free to move in a horizontal plane, revolving the shaft by means of a worm and gear, the proper track in which the groove was to be cut was presented to the cutter by the action of the pattern cam, the groove in which the pattern cam traveled on a sheave attached to a fixed stud in an upright arm extending up from the back end of the bed-piece on which the swivelling frame was pivoted. By this means the wall of the grooves were cut at all points parallel with the axis of the sheave in all its corresponding changing positions, but the groove was of different depths at different points, and having its walls, except for a small distance, at varying angles with the axis of the shaft. In cutting cams with a rotary cutter in which the motion of the cam is to be communicated through the agency of a sheave of the same size of the cutter, too much care cannot be bestowed upon the proper use of the principle involved in the cutting of the cam. Here was a case in which, in spite of the great variations of plane in which the sheave was obliged to work, owing to the swivelling motion of the lever, there could still be a perfect fitting of the groove on the sheave, while it is often the fact that in cases where cams are supposed to be cut with the grooves parallel with the axis of the shaft on which they are to run, there is much trouble in getting a sheave to run all around snugly enough to prevent lost motion, simply because either the cutter was above or below the center, or at an angle with the axis of the cam in cutting the groove, or else the sheave itself, in its attachment to the slide which is to be moved by it, is not in proper position. In such cases time would be saved by at once acting on the assumption that, if the groove was cut by a revolving cutter which ran true, and cut properly, a sheave as large as the cutter must run in the groove, if it occupies the same position relative to the cam which was occupied by the cutter during the cutting.

Drilling a hole or a starter something smaller and shallower than the finished groove is to be in width and depth, using spiral cutters cutting at the end as well as on the periphery, a roughing cutter slightly smaller than the width of groove first and a sharp fine-cut cutter to finish with, if the patterns are properly made and used, the cam-cutting machine of suitable construction, and sufficiently rigid in all its parts, the operation of cutting cams is very interesting and satisfactory.

On the machine to which I have referred as having been made specially for cutting the cam for a sewing machine, have since been cut thousands of cams for other uses, some with the grooves cut in the side of the disc, as in the case of the cam already described, but with the walls of the groove parallel with the axis of the cam. This was accomplished by the use of a cross slide, on which the shaft carrying the cam to be cut and the pattern cam were mounted. In the case of cams in which the groove was cut in the periphery, the slide might be used, or a more simple and cheaper device was to be found in simply allowing the shaft on which the pattern cam and the cam to be cut were placed to have a longitudinal motion, controlled by the action of the pattern cam on the fixed stud. A machine of this kind, with the spindle having a longitudinal motion through the revolving sleeve which furnishes the journals, and which carries the spindle by means of spline and feather—the spindle being fed forward or back by means of a ball joint and lever—is not only valuable as a cam cutter, but for some special jobs of drilling or die sinking is a handy tool to have. It is, in fact, many times in cutting cams the best plan to use a drill to remove a large portion of the material to be cut out, by drilling a succession of holes just breaking into each other for the entire distance to be cut. With an adjustable cutter on the sliding spindle set right for the depth, and turning the cam forward by means of the worm and gear the width of a hole after each drilling, the bulk of the material can be cut out very quickly, saving the milling cutters from much wear, and also avoiding an ugly habit which the cutter has of crawling out of the track in making short turns, when cutting the groove out of the solid stock.

A bill was recently passed through the Pennsylvania legislature requiring owners of mines to provide copper needles and tamping rods for use in preparing explosive charges. Many of the parties interested do not exhibit a disposition to comply with the requirements of this most judicious and humane law, and the miners in certain quarters are agitating to have the copper tools brought into universal use. An iron tamping tool is extremely dangerous in certain districts where substances are found so hard that iron will strike a fine spark on them, which in numerous cases have caused premature explosions spreading death and mutilation among the workmen. Should an accident now happen through the use of iron tamping rods the owners of the mine will incur a serious responsibility which will probably subject some one to a charge of manslaughter.

The Milling Machine—Its Construction and Uses.

By JOHN J. GRANT.

TWELFTH PAPER.

My intention is in these articles to show, amongst other things, the best way that has come under my observation of doing some of the *little* things, because I assume that these little things are really the important ones. They may look small to those who are familiar with them, but such will remember that the milling machine is, comparatively, a new tool, and that while a few are familiar with its use, the majority of mechanics have had little or no experience with it. I shall try and avoid anything that cannot be readily understood by the average mechanic. Some things involving calculations can be readily expressed by algebra, but I am sorry to say that not one machinist in ten, as far as my acquaintance goes, has the slightest knowledge of algebra, hence algebraical formulas for the angles of spirals, and for other purposes are all Greek to them. No man likes to expose his ignorance by going to some one—his superior in book knowledge—for the solution of a little problem that he would fully understand if stated in plain terms.

If the little everyday devices used, for instance, by the Messrs. Brown & Sharpe, in connection with their work done on the milling machine could be published, I am sure it would awaken additional interest in the use of the machine itself.

As generally made there is one weak point in the milling machine for general use; that is, the lack of a sufficient variety of speeds, both for the cutter arbor and the feed. The motions are neither fast enough nor slow enough. For instance, a cutter 2″ diameter should run, on common slab milling, about 40 turns per minute. The circumference of this cutter is 6.28″, or about 6¼″, and would run about 21 feet, surface speed, per minute. A cutter of ⅛″ diameter would have to make about 660 turns per minute, to have the right speed. Take then a cutter 6″ diameter; it should run at about 14 revolutions per minute, hence the variation of speed, for cutters from 6″ to ⅛″ would be from 14 to 660 turns, a variation that is not provided for. Of course the only thing to be done is to run the machine at the nearest approximate speeds to both extremes, and the result is broken cutters in the small sizes and dull ones in the larger sizes, besides not being able to accomplish nearly so much work, either with very large cutters or very small ones, as if the proper speed could be had. For this reason I advocate the use of back gears, which will remedy this. The cost of these for a small universal milling machine would not be more than ten dollars. Charge fifty dollars extra for the back geared machine, and I do not hesitate to say that not one in twenty that can afford to buy the universal milling machine would object to it; and certainly if the man that was to use the machine was consulted the back geared machine would be purchased every time. I do not advocate the back gears for the extra power they would give, but to enable the variations of speed to be obtained. The makers of such machines may object to this way of gearing the small machine, urging the plea that the machine would be abused by the workmen, if it was so powerfully geared. I think not, as the men who use this class of tools are generally intelligent machinists, and capable of judging for themselves as to the amount of hard usage the machine will stand without injury.

In the matter of speeds for feeding the platen, in my opinion, there are only about one half enough changes for the different grades of work that the machine is capable of performing; but if the cutter arbor speeds can be got right, the machine being a jobbing machine, the feeding is not of so much importance, as a large amount of the work is, or can be, fed by hand.

We won't ask for too much at once, but let us have this one fault remedied. It is very easy to find fault with machinery as constructed, but in this case I think the change would be of as much benefit—perhaps more—to the maker as to the user.

In a machine having no outside support for the end of the cutter arbor, both the arbor and the collars should be as large as possible, to prevent springing, as the more rigid the arbor the better the work will be that is done by it, besides the cutters will retain their edge longer. This is especially desirable when cutting spirals, as the cutter is generally at that time quite a distance from the end of the spindle.

Shank cutters, such as I described in a previous paper, are a very essential part of the equipment of the universal milling machine, and I would say, don't let any one induce you to make them with taper shanks. One trial will convince the most skeptical of the advantage of the straight shank over the taper one.

A very handy thing is a plate made of the same size as the bottom of the vise. The plate need not be more than ½″ thick, and should have a tongue on the bottom to fit in the slot in the table. It should be graduated with degree marks around the edge, and will be found extremely handy in milling off the ends of pieces to any angle, and cutting off the blind shoes that are put between the gib and the gib screws on bevel slides.

As there is a right and a wrong way to do almost every thing, it is best to know the right one and thereby prevent accidents to cutters and tools. The sketch, Fig. 9, shows the correct and incorrect way of running

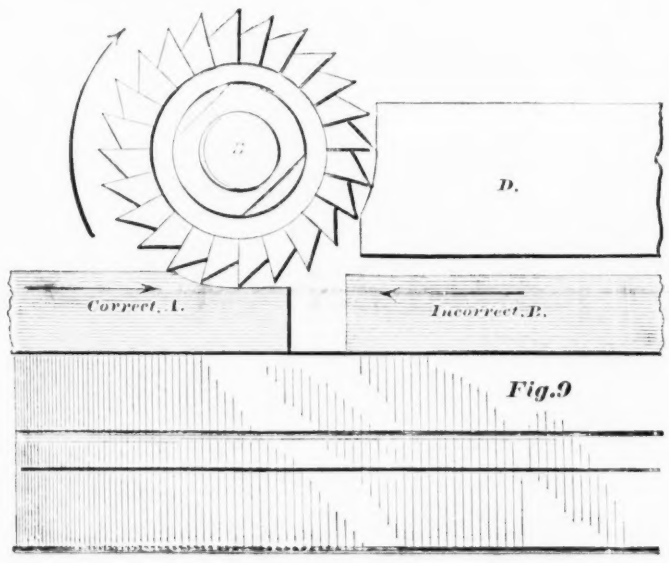


Fig. 9

the milling cutter on plain work, and is reproduced by permission from the work on the Universal Milling Machine, by the Brown & Sharpe Manufacturing Company. The correct way is shown at *A*. The reason for running the cutter this way is that it is then impossible for it to jump into the work, as would be the case if it were run as at *B*. No matter how perfectly the machine is made, the spring of the metal and arbor will be enough to cause the cutter to ride. *D* shows a piece of work being operated upon by the vertical movement of the elevating slide. When taking heavy cuts in this kind of milling, the movement of the cutter should be as shown, and the elevating slide or knee of the machine raised to the cut. But if a light finishing cut is necessary it can be taken by the downward motion of the knee. This can only be done when the cut is so light that the elevating slide will, by its own weight, take up the back lash of the elevating screw.

The extensive plant of a mill that has been engaged for years making paper from straw, in the neighbourhood of Iowa City, is going to be moved to Indiana. The machinery was driven by a fine water power on the Iowa River. Parties in Iowa City are arranging to operate electric lighting machinery for lighting the town by the water power now used by the paper mill. The place is five miles distant from Iowa City, and the proposal is to transmit the electricity that distance by wire.

Growth of the Train Brake.

By ANGUS SINCLAIR.

INVENTION OF THE WESTINGHOUSE ATMOSPHERIC BRAKE.

A new era of train control dawned when George Westinghouse, Jr., invented his atmospheric brake.

In this exacting age the traveling public are much more disposed to find fault with systems that do not provide against fatalities resulting from human fallibility, than to commend the perfection of appliances which annually save more lives than would be lost in a sanguinary war. The Westinghouse brake has performed this life-saving service, yet its great conserving merit has been but feebly appreciated outside of railroad circles. During the decade between 1860 and 1870, America became a reproach among nations for the frequency and disastrous nature of its railroad accidents. To-day fewer railroad travelers in America lose their lives by accidents beyond their own control than the travelers in any country under the sun. The credit of this immunity from fatal accidents is almost entirely due to the successful operation of the Westinghouse and other brakes that followed the line suggested by this invention.

DISTINCT CLASSES OF INVENTIONS.

Inventions may be divided into two distinct classes. Far the most numerous class are those which effect improvements on recognized appliances. The other is the rare and most valuable class, to which belongs the original inventor who devises an entirely new method for performing a desired operation. Among this class of inventions may be noted Watt's separate condenser, which first rendered the steam-engine a commercial success; the multitubular boiler of Booth, which made a high-speed locomotive practicable; and the air brake of Westinghouse, which made fast traveling safe by putting the train speed under the control of the engineer.

BENEFITS CONFERRED ON TRAINMEN BY GOOD BRAKES.

To the traveling public the air brake has proved a source of satisfaction by assuring exemption from accidents, but its greatest blessing has been conferred upon trainmen. Being the greatest sufferers from railway accidents, their risks of life and limb are greatly reduced, and the agonizing helplessness that used to be so often experienced with trains that could not be stopped in time to avoid a disaster is almost unknown on our well-managed roads. Mind has become victor in its conflict with matter. When necessary, an engineer can run a train at a high velocity over crowded lines without having to shut off steam within a mile of each point where there may be another train obstructing the track, or keep up his speed at the risk of his life. People unacquainted with the inside operating of railroads have no idea of the difficulties trainmen had to contend with in getting fast trains over the road before continuous brakes were supplied. The train had to be run on schedule time, and all points where trains might be expected had to be approached with care. This meant reduced speed, and speed could not be reduced in short distances, so the risk had to be taken of violating one rule to comply with another.

FIRST TRIALS OF THE WESTINGHOUSE ATMOSPHERIC BRAKE.

The Westinghouse atmospheric brake was patented April 13, 1869, and the first public trial took place on the Panhandle road about the same time. The trial was so satisfactory that the Pennsylvania Railroad Company, which have been always noted for their liberal patronage of every meritorious device likely to promote the efficiency and safety of railroad operating, had a train equipped with the brake. This was the Walls accommodation train, a kind of service where frequent stops were required, and was therefore well calculated to demonstrate the true character of any brake. A number of public trials were made with the brake thus fitted, among which was one by the Master Mechanics' Association in the middle of September, 1869, on the Horseshoe Bend on the Pennsylvania Railroad. Here a train of six cars running down a grade of 96 feet to the mile at the rate of 30 miles an hour, was stopped in a distance of 420 feet. Such a feat was unprecedented at that time, and attracted widespread attention.

In the following month official trials of the train were made by the officers of the Pennsylvania Railroad near Philadelphia. The train was then taken to Chicago, where numerous tests were made in the presence of leading western railroad officers. So convincing were these trials of the decided efficiency of the brake, that immediately afterwards the Michigan Central Railroad and the Chicago and Northwestern Railway each ordered a train to be fitted with the brake.

FIRST ROADS THAT ADOPTED THE WESTINGHOUSE BRAKE.

The first five sets of the Westinghouse brake fittings made were got out in the shops belonging to the Pennsylvania Railroad Company at Altoona, Pa. The first railroads to adopt the brake as a regular part of their equipment were the Pennsylvania; the Pittsburgh, Cincinnati and St. Louis; the Union Pacific; the Chicago and Northwestern, and the Michigan Central railroads.

Since the Westinghouse atmospheric brake was first tried, many changes in details have been made, and numerous improvements have been effected, but the essential points remain the same. And the best forms of brakes subsequently got out by other inventors are founded on the Westinghouse idea just as much as the numerous types of locomotives follow the design of Stephenson's Rocket.

OUTLINES OF THE ATMOSPHERIC BRAKE.

Although the automatic air brake is now becoming almost universal in American railroad practice, most trainmen are familiar with the working of the atmospheric brake under the name of "straight air." When first invented, the Westinghouse brake consisted of an apparatus located on the locomotive for compressing air, which was stored in an iron drum fastened somewhere about the engine. Underneath each car, and connected with the ordinary brake attachments, was a cylinder containing a piston, which operated the brake. The brake cylinders were kept in communication with the air drum on the locomotive by iron pipes. Connection between the cars where "stretching" and "compression" made the train vary in length was made by means of rubber flexible hose. When the engineer wished to apply the brakes, he admitted the compressed air into the supply pipes through a three-way cock at his hand. This air entered the cylinders under the cars, moving back the pistons which pulled the levers operating the brakes. To release the brakes, the air was permitted to escape out of the pipes into the atmosphere.

Thus, what is really a complicated operation was performed in a simple manner, and by means of machinery not liable to get out of order readily. The instant application of

every brake on a long train was put in the hand of the engineer. On the first indication of danger his hand became powerful beyond the magical forces conceived by the imagination of poets.

HOW EASTERN RAILROADS KEPT ALOOF FROM THE WESTINGHOUSE BRAKE.

The growth of the Westinghouse brake into public favor furnishes a curious commentary on the different degrees of enterprise to be found among railroad companies in the various sections of this country. It was natural to suppose that railroads in the thickly settled States, where trains had become too numerous for being safely operated with crude brakes and no signals, would have been the first to adopt an improved appliance which gave promise of increased safety. Yet the railroads in the Eastern States, with a few creditable exceptions, were among the last to patronize the Westinghouse brake, and they only adopted it when the influence of public opinion could no longer be ignored. Western railroads that ran through sparsely settled prairies, where trains were rare and stopping room generally ample, were among the first to encourage the inventor of the brake with their support.

LESSON OF THE REVERE RAILROAD ACCIDENT.

During the first two years after it was invented, the Westinghouse brake made slow progress into practical application, except in the West. In the ancient State of Massachusetts it was hardly known till the Revere accident happened near Boston. This was the case of a crowded road being operated without signals or brakes, except those of the most primitive description. A fast express train ran into the rear end of an accommodation train, killing twenty-nine persons and severely injuring fifty-seven others. The engineer of the express train, while running at a speed of twenty-five miles an hour, saw the tail lights of the accommodation train when he was eight hundred feet away. He whistled for brakes, and reversed his engine, but the train could not be stopped. The railroad superintendents throughout the conservative State of Massachusetts then received enlightenment respecting the existence of an efficient continuous brake in a vigorous fashion. The Revere accident conveyed its lessons in a terrible way, but they were effectual in convincing railroad managers that they could not afford to dispense with a brake that proved itself to be reliable.

Process of Making Bessemer Steel Rails.

The following brief and plain description of the process of making Bessemer steel rails was prepared for the information of persons who have never witnessed the operation. Both the engraving and description are published by the Pennsylvania Steel Company, in a new catalogue of switches, frogs and improved safety appliances for railroads. To that company we are indebted for the cut and permission to publish in the AMERICAN MACHINIST.

"Bessemer steel is produced from pig iron, which must be of a particular quality made from the purest ores, although its appearance is same as the iron commonly used in foundries for making castings. It is the common practice to melt the iron in the converting department, as in this way a better commingling of the various qualities is obtained, but the iron is sometimes brought in the melted state, directly from the blast furnaces in which it has been made, in large ladles mounted on trucks running on elevated tracks into the converting department. The ladle must in either case stand at a considerable height from the general level that the melted metal may flow through suitable troughs into the 'converting vessels,' and the cupolas are placed still higher, so that the iron may run from the cupolas into the large ladle.

"The 'converters' or 'vessels' are large egg-shaped affairs made principally of heavy plate iron, with trunnions on which they turn up or down, and they are connected with powerful hydraulic machinery by which they may be made to turn as desired. The converters are lined very thickly with fire bricks and other refractory materials adapted to resist the intense heat. The bottom or lower part of the lining is made of perforated fire bricks (called tuyeres), through which the air is blown into the converter, and this part is made to be readily removed and replaced when necessary. The air is conveyed by passages extending through the trunnions of the converter, connecting with pipes leading from the engine.

"To receive a charge, the converter is turned down so that the mouth is opposite the end of the troughs or 'runners' through which the iron flows down and pours into the converter, the iron giving off quantities of sparks and making a brilliant spectacle, which is, however, surpassed by that presented when the air is let on and the converter turned back to the upright position, as the powerful blast of air (20 to 25 lbs. pressure per square inch), when it first bursts through the metal, forces out showers of bright sparks, which for a moment appear to fill the air.

"As pig iron contains about two per cent. of silicon, and four per cent. of carbon, and as the steel must be practically free from silicon, and have only about four-tenths of one per cent. of carbon; to convert the iron into steel the silicon and carbon must be entirely removed. By forcing through the molten pig iron such immense quantities of atmospheric air, the carbon in the iron combines with the oxygen of the air, and being consumed, passes off in the form of gas; the silicon being also oxydized, is removed from the iron, and when all of these elements are thus expelled, the material arrives at the condition (chemically) of pure iron, and is then ready for the addition of the recarbonizing material which returns to the charge enough carbon to give the steel the required carbonization.

"To convert a charge requires from 15 to 20 minutes. At first there is comparatively little flame passing out of the converter, but it rapidly increases, passing with a dull roar into chimney stacks above the mouth of the converter. As the blast continues, the flame increases more and more, and grows in brilliancy until it rivals the light of the sun and becomes too bright for unaccustomed eyes, passing out of the stacks high into the air, lighting up at night the vicinity; the noise having also increased to a roar which may be heard at a considerable distance. After the carbon has been expelled the flame loses brilliancy and drops very noticeably, the blast is shut off and the converter is turned down. As the converter is turned down, the blast again sends out a splendid shower of sparks. At this point the recarbonizing material is introduced. This is Spiegeleisen, a metallic combination of iron and manganese with carbon. It is melted same as the pig iron, and a quantity proportionate to the weight of the charge is run into the converter. It instantly pervades the metal in the converter, throwing off flames of a very peculiar hue as the manganese and carbon combine with the metal, and the charge at once becomes steel and is discharged into the steel ladle.

"In front of the converters are two semi-circular pits several feet deep, and in the center of each pit the powerful hydraulic crane which supports the steel ladle is placed. The steel ladle is swung around under the mouth of the converter and the steel is poured into the ladle, after which it is swung back over the cast iron moulds that are ranged along the side of the pit and the steel is discharged through the bottom of the ladle into the moulds, where it soon congeals and takes the form of "*Ingots*," con-

MAKING BESSEMER STEEL.

taining enough steel for several rails. After the steel is poured out of the converter another charge of iron is run into the same or another converter, and the above repeated. As there are three converters in the converting department of the Pennsylvania Steel Company one is always ready to use, and the process goes on day and night. As soon as the ingot loosens itself from the mould by contraction the mould is stripped off, and the ingots are loaded, soon as possible while red-hot, on to trucks for removal.

"The ingots, ladles, moulds, and all heavy articles, are handled by the aid of hydraulic cranes whose power is derived from powerful pumps that furnish a pressure of 280 pounds to the square inch, the pressure being applied by persons stationed where they can observe every operation and apply the pressure as it is needed.

"When a charge of ingots has been loaded on the trucks a small locomotive speedily moves it to the Blooming Mill where the ingots are re-heated in furnaces, and are then passed through the blooming rolls which reduce the size to seven inches square. The

ingot is then cut into pieces of length required to make a rail, which under the name of 'blooms' are conveyed to the rail mill, where the 'blooms' are re-heated and rolled into 'rails.' After the rails have cooled they are inspected to find any defects, made straight and true, and drilled at the ends for the splices."

LETTERS FROM PRACTICAL MEN.

More Western Shop Kinks.

Editor American Machinist:

At the request of my Western friend, I called to see him to-day as he wished to show me a device for truing the guide-grinding emery wheel. The old way, says he, was to hold the diamond in the hands and true the stone by guess. To fix up the device shown in Fig. 1, I have drilled and tapped two holes on the surface of the emery wheel frame to which I can bolt it. By shoving the sliding block which contains the diamond and holder back and forth, I true the stone to perfection which is a good advantage over the old way. Nothing is more aggravating to the man who tries to grind a surface true, than to have an emery wheel out of shape. That is a little worse than the typical corded grindstone.

I saw in the AMERICAN MACHINIST some time ago, a device for centering work on the lathe. It consisted of a sheet iron plate fitted to the lathe Vs, and extending up to the center at which point there was a center point mark for placing one point of the dividers. It is a good idea, but I do not like it because if a fellow wishes to leave the shop it would be unhandy to put in a tool box. As I consider something of the kind an indispensable tool for centering driving boxes when they are bored on the face plate of the lathe, I have modified the plan, and make use of one like Fig. 2. That I place between the centers, supposing the line center to be true. The nut you see on the bar is nothing more or less than what I use on my surface gauge.

Fig. 3 shows a bar I use in carrying pistons. My helper says it is not a fair division of labor to make him carry the whole of the big end. As the weight of a complete piston for a big locomotive is considerable, I acknowledge the cogency of my helper's objection. As room is sometimes too limited for two men to walk abreast supporting the head of the piston by a jack lever, I got out the bar shown in the sketch. I place the lugs of the bar in the packing rings slot, and two men can trot along with the piston in a straight line, neither of them having too much to carry.

LT. C. SHARP.

Plattsmouth, Neb.

Boilers, and Boiler Repairing.

Editor American Machinist:

I am of that trade that seems to have incurred Chordal's dislike—who gloat over the use of the drift pin, and who keep their worldly goods in old barrels, viz., a boiler maker—and could tell such of your readers as care to know something about dangerous boilers, some things. I examined a boiler not long ago—a two-flue boiler, 36″ diameter by 12 feet long—where the owner sent a man inside to plaster the inside with mud to a depth of 3″. I shoved an iron barrel hoop into the boiler along the caulking edge of the middle rim for a space of 30″, and that boiler had been running steadily for months, carrying 80 pounds pressure.

I was called off to examine another boiler, and just here let me describe how I found things: Three two-flue boilers, 36″ diameter, about 14 feet long, connected in a nest or battery, two of them connected with a steam drum across them, and the other connected with a 2½″ steam pipe. One safety valve answered for all, and it had in addition to the weight the following articles hanging on the lever: The wrench for the manhole bolts, an old connecting rod strap, a piece of railroad iron about 15″ long, and an old spur gear. Steam gauge there was none, and

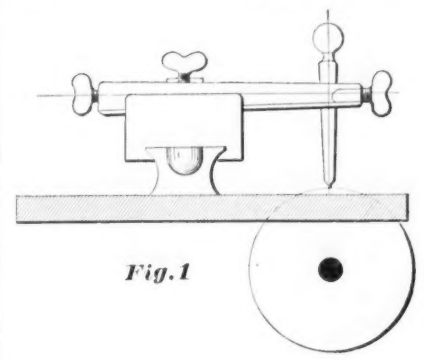


Fig. 1

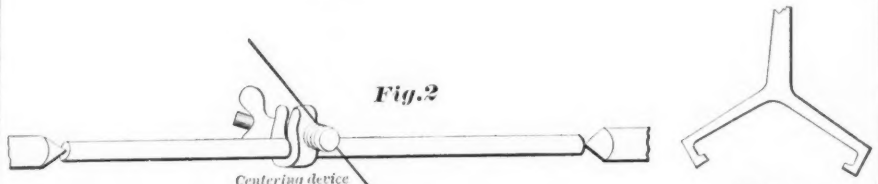


Fig. 2

Fig. 3

WESTERN SHOP KINKS.

gauge cocks only on the middle boiler, the screws of which were lost, and had pieces of wood inserted in the holes instead. The fireman told me they answered first-rate, and saved him lots of trouble, for, as they always leaked badly, he could tell at a glance whether it was steam or water. I found the middle rim broken—not cracked, but broken from the manhole on top to a patch on the bottom. I put in a new half sheet, and in less than a week the other half went. I put in the other half sheet, and before the men had got properly started in the shop again the owner came along and ordered new boilers. The sheet we put in first had cracked in the middle, just like the old one. I advised him to order new boilers when I first saw them, but he had a bill of wood to saw, and couldn't stop.

So it is here. As long as a boiler will hold water it is all right, and I have been asked if I couldn't fix a boiler temporarily, the crown sheet of which was down 6″, and the top row of tubes sagged down to the second. The owner had twenty bales of cotton to gin, and didn't want to stop.

JAMES HUMPHRIES.

Foreman boiler maker Geo. R. Lombard & Co., Augusta, Ga.

Improvement in Micrometer Calipers.

Editor American Machinist:

In your issue of December 1st I notice an illustration of a new micrometer caliper. The same thing in an improved form, of which I inclose a rough sketch, has for a year or more been in use here. Fig. 1 shows the end view of the improvement, which is drilled to fit on the screw, and the slot in the flat part is made to receive the scale, as shown in Fig. 2. By using this collar the scale is kept steady, and a more correct and convenient way of reading provided, as by its use the scale can be read from the edge of the collar, and by placing a mark on the collar, as at *a*, Fig. 2, the thousandth can be read more correctly than by using the edge of the scale.

The milled end of the screw is tapped and screwed up against the collar, thus providing a convenient method for taking up any wear that may occur at that point.

J. R. L.

Cincinnati, O.

A Cheap Cutter Grinder.

Editor American Machinist:

To use the words of Mr. Grant "anything done to help to introduce the milling machine is surely missionary work for the machine shop." As I always had great notions about being a missionary, and this being the first time I have felt directly invited, (by the way I never felt exactly like taking a trip of 9,000 or 10,000 miles before I begun), I will try and explain how we grind cutters, away back in—well, I won't say just exactly where.

Grinding the cutters always seemed to me to be the great bugbear in the way of using milling cutters in the lathe, and the expense of a suitable grinder, one of the principal obstacles in the way of buying a plain milling machine. To grind plain surface milling cutters we brought into use the common emery grinder as ordinarily used with two rests, and a 9″ wheel, it being the smallest we had. (The only difference between our grinder and those ordinarily used is that our wheel runs true, that is, pretty near true.)

Our cutters have an inch hole, and we made the piece shown in Fig. 1. This consists of the angle piece, *B*, one arm of which fits the rest stand, while to the other arm, *C*, the sleeve, *a*, having a ⅝″ hole through it, is fitted. This sleeve is long enough for the thickest cutter we use, and will also hold the thinnest.

The tooth rest, Fig. 2, is simply a rod of iron with a piece of spring steel inserted in the top. The arrangement of the parts may be seen in the sketch, Fig. 3.

The only things to be looked out for in making this rig, are to have the angle arm stand in the same horizontal plane as the shaft of the emery wheel, and for straight cutters have the top edge of the tooth rest also in the same plane. Then if you want to grind angle or any other kinds of cutters, except the plain surfacing cutters, you must contrive some other way to do it, because this rig won't work. UNCLE CHARLIE.

Wayback, * *.

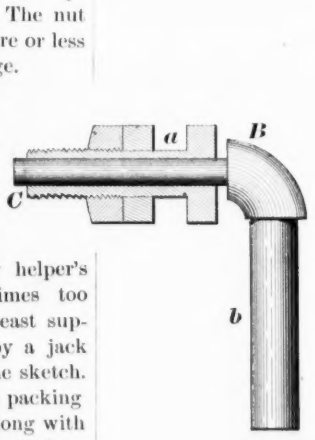


Fig. 1

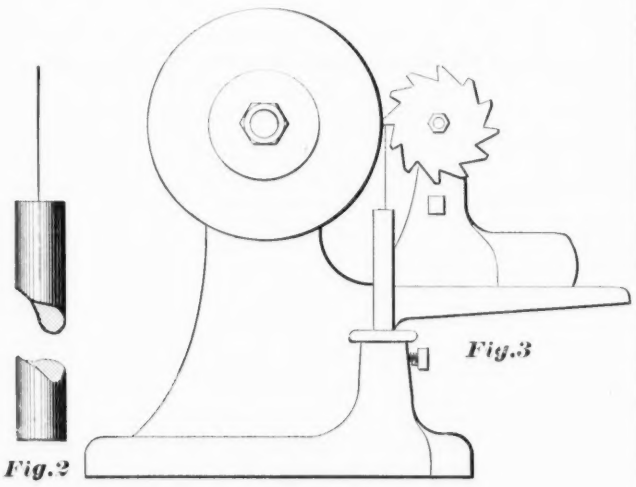


Fig. 2

Fig. 3

A CHEAP CUTTER GRINDER.

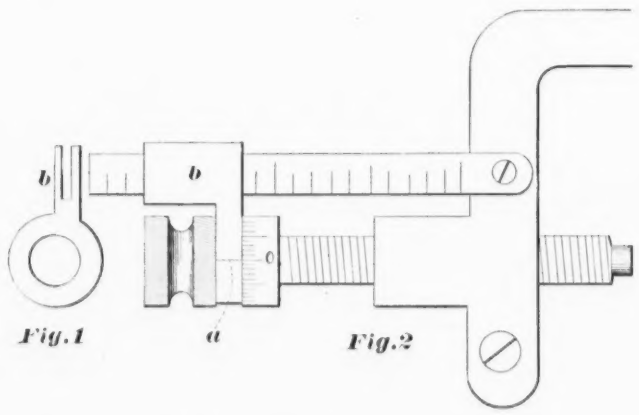


Fig. 1 *Fig. 2*

Raising Water by Suction.

Editor American Machinist:

In your issue of December 8th is a description of a pump raising water by suction lift 37 feet—beyond the atmospheric limit. The explanation given by Mr. Stewart is insufficient, in fact it "won't hold water." The action of the pump will not suck the water out of the stand pipe, as he says, there being a vacuum there already, as in all the parts of the suction pipe. The figures would indicate even more than an absolute vacuum if it were possible. The law of atmospheric pressure is immutable, and some other explanation must be looked for. In "Ewbank's Hydraulics," page 224, is mentioned the case of a tinman of Seville, in Spain, who undertook to raise water 60 feet, making the "sucker" work only within 50 feet of the water. Becoming exasperated at the failure of the pump to work, he threw the hatchet at it and cut a small hole about 10 feet above the water, when the pump instantly commenced working. The explanation there given is, that the air mixing with the water makes it lighter, and therefore a higher column can be raised. Other instances of the same kind are given. C. W. CRAWFORD.

Pumping Water Thirty-Seven Feet by Suction.

Editor American Machinist:

On page 6, No. 49, of the AMERICAN MACHINIST, you give Mr. Stewart's illustrated description of a new method of raising water by suction—really, atmospheric pressure.

Now, as this pressure averages about 30 inches of mercury at Buffalo, and as one inch of mercury equals .879 feet of water (both at 60° F.), it follows that water will rise about 34.13′ in vacuo at that place. Possibly, once in five years it may reach 35.5′. If the pump is in a hot well, it would rise higher, say at 100° F. to 36′. The "suction pipe" and the "stand pipe," as he may very well call them, are of equal height. It don't seem possible that the water in the "stand pipe" can be drawn out of it in the way he says. The water would, of course, seek the same level in both pipes when open, and why not when closed?

If the pump piston should be operated with the cap *off*, then no doubt the "stand pipe" would be quite nearly emptied of its supply of water. With the cap on, air tight, it will remain full, or, at least, level with the water in the "suction pipe." It would seem that there must be some mistake in the measurements. The only possible use of the "stand pipe," in any case, would seem to be to afford some relief as a cushion against shocks at the check valve.

This story reminds me of a little incident of nearly 25 years ago. The first steam fire engine, the "Gen. Butler," had just been received in the city of Lowell. A trial of "spunk" was immediately in order. The machine was taken out upon a bridge, the suction hose dumped over the rail into a canal,

the surface of which was nearly 20′ below the pump. When the steam pressure reached 60 pounds, the capacity for drawing water was also reached. Steam went up to 80, 100, and 120 pounds, but "as to throwing the stream any further, she wouldn't," notwithstanding her name. Here was a first-class conundrum for the wise heads who had the thing in charge. They solved it thus: "She don't get water fast enough," said one. "She don't catch all the suction takes up," says another. "Part of it runs back again," says the third. "A check valve is what she wants," comes from the profound genius in charge, the engineer. A check valve it was, and another trial made on the same spot, with no better success than before. It was plain enough that the check valve didn't mend matters.

It is not known what became of that check valve, but the engineer who proposed the scheme has since got "well off" making and selling machinists' tools, some of them with more than one check valve about them.

People seem to think it makes but little difference with a "suction pipe" as to its capacity to supply water, whether the pump is one foot or 25′ above the well water. They know it takes more power to work the pump. They don't seem to know that the water will flow into a pump chamber at the rate of 46′ per second when only one foot high, and at less than half of that when 26′ high; and that in the latter case the pipe ought to be of more than twice the cross-sectional area of the first.

Perhaps the following table of velocities, arranged with special reference to the subject under discussion, may be found useful:

TABLE OF THE VELOCITY OF WATER FLOWING INTO SUCTION PUMP CHAMBERS FOR EVERY FOOT OF HEIGHT OF PUMP. ABOVE WELL WATER FROM 1′ TO 34′, INCLUSIVE. BAROMETER, 30. THERMOMETER, 60° F.

Height of Pump.	Velocity of Flow into Pump Chamber.	Height of Pump.	Velocity of Flow into Pump Chamber.
	Feet per Second.		Feet per Second.
1	46.16	18	32.21
2	45.45	19	31 19
3	44.75	20	30.14
4	44.01	21	29.06
5	43.28	22	27.93
6	42.53	23	26.75
7	41.77	24	25.52
8	40.90	25	24.23
9	40.20	26	22 80
10	39 39	27	21.41
11	38 57	28	19.85
12	37.72	29	18.16
13	36.86	30	16.29
14	35.98	31	14.18
15	35.07	32	11.70
16	34.14	33	8.52
17	33.19	34	2.89

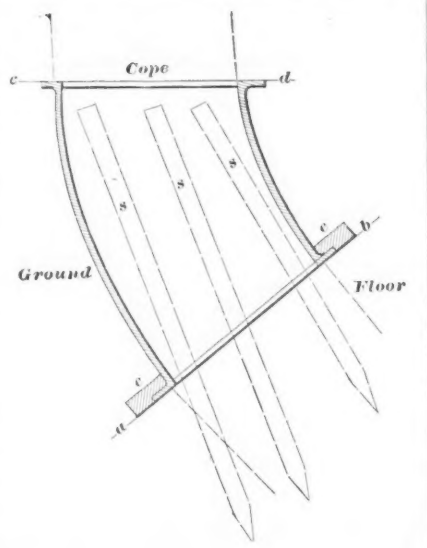
Pumps of this kind might, and often would, fail, when set 30′ above the surface of the well, simply because what vacuum pressure remained would not be sufficient to overcome the inertia of the check valve. Pumps have been torn from their fastenings because the plunger speed, and the capacity of "suction pipe" and check valve, were not properly adapted to each other. In every case they should bear a certain proportion one to the other, in order to operate with the least practicable expenditure of power.

H. DYNAMICUS.

How a Curved Pipe Was Made from a Straight Pattern.

Editor American Machinist:

A short time since a customer called on me for a piece of cast-iron pipe to make a curve of about 30 degrees in a pipe about three feet in diameter. He wanted it forthwith for a repair job. Having no such pattern, nor forms for sweeping such a mould, I made the piece in a creditable manner by the means shown in the accompanying sketch. First I got a pattern of a rim for a pulley, which was about ¾ inch thick, 6



inches wide and 36 inches diameter, made with but little draft, so it could be drawn up to make a wide rim, making what is known as an anchor pulley. Around this pulley rim I fitted a set of cores, a section of which is shown at *e*. In the under side of these cores was a recess, to form one of the flanges of the pipe. I also had a piece of a circular flange pattern fitted to the outside of the rim pattern, which piece of flange pattern was about one-sixth of a circle, and was like the required pipe flange. I was then ready to make the mould, which was done by excavating in the ground floor deep enough for the casting—say about 4 feet—and then ramming and grading a true surface at an angle as shown by the line *a b*. This surface was made true in a manner similar to that employed for making surfaces true and level in pits, by bedding a turned iron pulley rim in the sand by a spirit level, and using a straight edge over the edge of the pulley rim, and after the surface was finished, drawing out the pulley pattern and filling the hole left by it.

After truing the surface, *a*, *b*, the 36 inch pulley pattern was laid down and the cores, *e*, *e*, set around it, and sand then rammed hard, both outside and inside the pulley rim, nearly level with the top. Then several holes were made with a bar, and some strong stakes, *s*, *s*, *s*, driven into them. A computation showed the pipe would be about 33 inches long on the short side, and about 50 inches on the long side. The pulley rim pattern was then drawn up 1½ inches on the side, *a*, *c*, and 1 inch on the side, *d*, *b*, when more sand was rammed inside and outside, and the pattern again drawn up in the same way as before, *i. e.*, 1½ inches on the long side and 1 inch on the short side. This operation was repeated until the pattern was raised to the line, *c*, *d*, when the surface, *d*, was leveled off to the top edge of the pattern and the cope staked in position and rammed up. The cope was then taken off and the sand cut out around the outside of pattern so as to bed the section of flange pattern, and ram it level with top of pattern, then the flange section was moved along and rammed again until the flange mould was carried entirely around the pulley pattern. The pulley pattern was then drawn, the cope put on, and runner built, and it was ready for the iron. A thorough venting of the cores, *e*, *e*, was secured by a vent rod rammed in the sand over each core, and a vent wire was thoroughly used in every direction from the starting place of the lower end of the vent rod toward the cores.

Although the pattern was nearly a straight cylinder, the marks of the pattern when it was drawn was scarcely perceptible.

Had time permitted I should have made an entire circle of the top flange pattern, and for a heavy piece would prefer to vent the cores in a cinder bed underneath the mould.

OLIN SCOTT.

Bennington, Vt.

Originality of a Patented Device.

Editor American Machinist:

In your issue of December 8th, 1883, in your description of "The Thompson Improved Indicator" you make the following statement:

"One of the more recent improvements, and one which to a large extent obviates the use of carrying pulleys, is represented in Fig. 3, and is the subject of a recent patent, &c."

Now, as regards the recent patents there must be some mistake as well as a *recent improvement*, as this exact device was in use in different parts of Europe, and was also described and illustrated in the London *Engineering* as early as January 25th, 1878, as proposed by Mr. Stanek, of Prague. *Engineering*, after describing it, says: "In comparing this arrangement with that usually employed it will be found that the cord can be moved more freely in any direction without interfering with the correct action of the apparatus. Moreover, the arrangement, if once properly adjusted, is not liable to allow the cord to double on the paper drum pulley—that is to say, to go round more than once—a case which is by no means uncommon with the ordinary pulleys."

W. BARNET LE VAN,
3607 Baring st., Philadelphia.

An Expanding Mandrel.

Editor American Machinist:

I send you a sketch of an expanding mandrel which may be of some interest to some of your readers, as well as perhaps useful. The sketch, with the following description, will no doubt give the idea of it. (Fig. 1 is a side view, and Fig. 2 is an end view with nut removed.) *A* is the body of the mandrel, which has a taper turned on one end to receive a sleeve *B*, which is bored to fit this taper. This sleeve is turned the required size for the hole in the work for which it is intended to be used, and is cut into six parts, as shown in Fig. 2. The sleeve is turned down at each end at *C C*, and rings slipped over these offsets, with sufficient room to allow the cut sleeve to expand. These two rings are connected with each other by three rods *F F F*, which are turned down on the ends to form shoulders, and fit into the holes in the rings and are riveted together with the cut sleeve in the rings. Before riveting, the sleeve is cut out wide enough at *F F F* to allow the rods to pass from end to end of sleeve without projecting above the surface. These rings and rods are for the purpose of holding these sections of the sleeve together, so that they cannot fall apart when removing the work.

Fig. 1

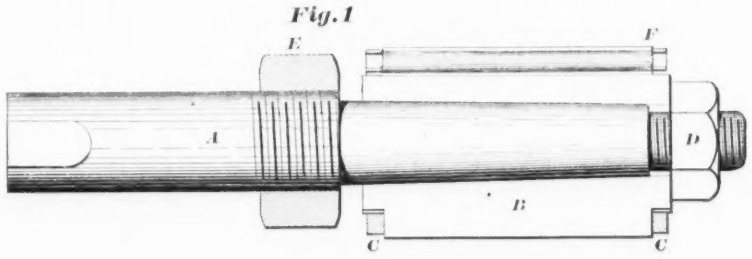


Fig. 2

The nut *D* on the end of the arbor is for the purpose of tightening the mandrel in the work, and the nut *E* is to loosen it, thus avoiding the use of the hammer to fasten or loosen the work, and also the rubbing of the surface of the mandrel in the hole, as is the case with ordinary mandrels, and which often spoils the hole, if proper care is not taken. This also avoids battering the end of the mandrel, as is the case where the hammer is used.

The holes in the work may vary in size as much as $\frac{1}{32}$ inch, and still the mandrel can be used without any inconvenience.

I made several of these mandrels a year or more ago, which are in use in the shops where I am employed, and are giving excellent satisfaction. Thinking others may derive some benefit from it, I send you this sketch and description.

A. B. LANDIS.

A Technical School that Gives Instruction in Foundry Practice.

Editor American Machinist:

I was considerably amused to see in the number before last a long communication, signed "Foundryman," complaining that the technical schools do not give practical instruction in foundry matters. He had better wash the parting sand out of his eyes, and look around a little. We have a brass and iron foundry, 380 ft. x 48 ft. 6 inches, with one of Colliau's cupolas, capable of melting down a ton per hour. We "take off" one heat, and sometimes two heats, per week. We employ a moulder constantly to give practical instruction to our students, who make patterns, mould them up, weigh up the coke and iron, melt and pour off; and, by the way, we have one of the best core ovens I have ever seen anywhere. If "Foundryman" will send me his address, I shall be glad to send him our University Register.

J. L. MORRIS,
Sibley College of Mechanic Arts, Cornell University, Ithaca, N. Y.

Flather's Work-Holding Machine.

The machine, illustrated on this page, is a hollow stand with a chuck on the top, and having two of the sides cut away for convenience in taking out the reamers and taps after they have been through the work. The machines are made in two sizes. No. 1 will take in work from 20″ diameter down to 1¼″ diameter, and has a hole through center of chuck 4″ diameter. No. 2 will take in work from 30″ down to 3″ diameter. The jaws of the chuck are made from steel castings, and are extra large and strong. The screws that actuate the jaws are made of the best machinery steel. All parts subject to bruising strains are case-hardened. Quite a number of the machines have been sold, and those who have used them find their use greatly facilitates work. The machine is patented and made by Mark Flather, Nashua, N. H.

L. S. Johnson, Walpole, Mass., has invented a machine for manufacturing fish lines, twine, and small rope, which is claimed to do five times more work than any other machine now running. It has an automatic stop motion and a positive feed, so that when a strand breaks the machine stops itself. If a spool gets empty, the machine stops. It will, if desired, put in a straight center thread or core. One man can run several of these machines.

Frederick B. Miles, Philadelphia, Pa., has received a patent for improvements on a steam hammer. The patent covers certain combinations which are likely to produce a convenient and durable hammer.

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NEW YORK, DECEMBER 22, 1883.

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The People Decide Against the Prison Contract System.

The complete count of the vote in the State of New York, on the proposition to abolish the prison contract labor system, has at length been published. The vote was 405,882 for, 266,966 against, the proposition, thus showing a clear majority of 138,916 against the present odious and unjust plan of jobbing out the labor of convicts to a few contractors, who grow rich at the expense of free industries. The contractors and their apologists of the press will find only cold comfort in contemplating the figures recording this direct verdict of the people. More than two-thirds of all the voters who went to the polls gave expression to their opinions upon this industrial question by depositing their ballots. Not far from one-half of all the voters gave their decision in favor of doing away with the contract system. In the cities, where the question had been the most fully discussed (at public meetings and otherwise), the majorities against the contract abomination were overwhelming. Only in rural counties, where comparatively little attention had been given to the matter, were majorities obtained in favor of the system. In these localities the contractors had circulated pamphlets and essays to create a belief that dispensing with the present system would largely increase taxes. There is no good reason why this effect should follow. Furthermore, property-owners in cities already pay heavier taxes than those in the country, and would have to assume their proportionate burden of any additional tax levied by the State. Further discussion of the question will develop even a stronger popular demand for the banishment of the contract system. If the New York State Legislature represents the people (as it should) an act will speedily be passed forbidding the letting out of any more prison contracts. They cannot escape early action upon the ground of having to provide a system of public employment for prisoners on too short notice, for contracts for the labor of most of the convicts have from three to four years yet to run.

If a vote were taken upon the same proposition in other States, it would doubtless result in just as strong a popular condemnation of the prison contract system as the recent vote in the State of New York. Shall the interests of the whole people be considered in legislation or the interests of a few wealthy contractors, who are fast becoming millionaires?

Defective Methods of Handling Heavy Work.

We recently heard a gentleman in charge of the building and equipment of a new establishment intended for the construction of heavy machinery, talking about traveling cranes. He objected to traveling cranes because they were costly, and he believed it would pay them better to move their material as others have done successfully for years, making money all the time. We did not presume to know the business better than the engineer in charge; but the conversation impressed us forcibly with the truth that the ordinary American ideas about what are the best means of handling heavy material are somewhat antiquated. That same superintendent would have nothing in the shop in the way of tools that were not of the most approved patterns, and every mode of facilitating production received close attention, except in the matter of transferring the material. Any one who has examined first-class European shops and compared them with those in this country, cannot fail to be struck with our deficiencies in the way of moving material. By means of templates and jigs we finish work accurately with surprising rapidity, without having to employ highly skilled labor. We make machines that excel the productions of other nations for the complex mechanical actions they will perform without human help; but the material to be operated upon is often dragged to the machine by the primitive appliances, that were probably in use among the builders of the pyramids. Where work to be handled is light, it does not matter so much if manual labor is left to do the lion's share of the lifting; but where heavy massive forgings or castings have to be moved with defective appliances, the ordinary operations of the shop are often seriously delayed and the regular work interfered with. Tools and men kept idle, through the want of proper means of handling material, soon runs up a bill that would pay for the best appliances. We hear a great deal about the cost of labor preventing us from competing on even terms with European makers in certain branches of trade. These are the branches where our builders have not done their best to make machinery do its proper share of the work. In all light work we are independent of foreign competition; in heavy work we cannot hold our own. There is no effect without a cause.

"London Smoke."

Everyone interested in fuel consumption will find the paper on our first page under the above title of more than ordinary interest. The author, J. C. Hoadley, is well known as an eminent engineer and expert, and one whose experiments are noted for the accuracy of the methods employed. The supposed loss of fuel passing away as unconsumed carbon, or smoke, has been a promising source of predicated economy, and the foundation of numerous patents as well as the basis on which companies with high sounding titles have been formed to save anywhere from twenty to fifty per cent. of fuel used. Mr. Hoadley's experiments show how small this loss really is, and that smoke "consuming" devices must stand upon some other bottom than that of an enormous saving of fuel. In a general way his experiments are interesting as showing how one or two simple facts may overturn any amount of high-spun theory.

Every once in a while some subscriber writes us, requesting us to change the mailing address of his paper, and forgets to sign his name, or give his present location, or mention the State in which the new post-office is located, or something of the sort, obviously preventing us from complying with his wishes, or, in the first two instances mentioned, from asking for better information. Where the name is given but the present address is not stated, to attempt to comply with the writer's desire, may mean searching through our whole mailing list, containing thousands of names, an expenditure of time and labor which in a busy office is simply impracticable. We are always glad to oblige our friends, but full particulars should be stated in all such cases.

Occasionally, a subscriber writes us asking if a certain advertiser in our columns is reliable, and stating that he has remitted money to the advertiser without acknowledgment or return. It is not our intention to admit advertisements to our columns which we have reason to believe are fraudulent. Knowing the advertiser well, in a recent instance, we referred the complaint to him, and learned that the difficulty was caused by the careless manner in which our subscriber's name was signed to the letter making the remittance, rendering it impossible to do more than guess at the name. Letter writers who delight in complicated styles of signature, should take the precaution to prepare and use a printed letter-head, correctly giving name and address.

Another bad practice is that indulged in by many readers who desire information through our "Questions and Answers" column, but neglect to give their names. The name need not be published unless the questioner chooses, but we must in all cases know who he is.

Literary Notes.

The second issue of the *Saw Mill Gazette*, published by M. T. Richardson, 47 Barclay Street, New York, is before us. It is a neat and well made-up paper, containing much practical matter for lumbermen. It will be issued monthly at $1 a year.

MONCKTON'S PRACTICAL GEOMETRY; being a series of lessons beginning with the simplest problems, and in the course embracing all of Geometry likely to be required for the use of every class of Mechanics, or that is needed for instruction in Mechanical Schools. Illustrated by 42 full-page plates. By James H. Monckton, author of Monckton's "National Carpenter and Joiner" and Monckton's "National Stair-Builder." Instructor for many years of the "Mechanical Class" in "The General Society of Mechanics and Tradesmen's Free Drawing School" of the City of New York. Published by William T. Comstock, 6 Astor Place, New York.

This little book will be found valuable to apprentices and mechanics who desire to study that part of geometry which will be useful to them in their trades. All mechanics make more or less use of geometry, sometimes unwittingly, and the systematic study of the subject as laid down by the author will be found well suited to their wants. The subject of drawing, so far as it relates to the delineation of the figures considered, is treated, and a young man commencing at the beginning and going regularly through the work, will, in addition to the knowledge of practical geometry, have a valuable start in the study of mechanical drawing.

The small price at which the book is sold, viz.: $1, places it within the reach of every one.

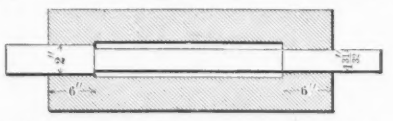
John Wiley & Sons, 15 Astor Place, New York, are contemplating the publication of a book to be entitled, "The Wind-Mill as a Prime Mover," by Alfred R. Wolff, M. E. Mr. Wolff has made a special study of the subject for some years, and has already contributed valuable papers upon it. With a view to determine the probable demand for a book of this character, the publishers have issued a circular, which will be sent on application, and which gives a synopsis of the contents. To this circular they expect replies from those who will purchase the book.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(398) A. S. P., Paterson, N. J., writes: I have a canvas canoe, but there is so little wood used in its construction that it will sink when filled with water: 1. What would be best to put into it, cork or bladders? *A.*—We should say cork would be the best. 2. How much cork would be required to support a weight of 160 lbs.? *A.*—About 3½ cubic feet.

(399) F. H. P., Fishkill, N. Y., asks: What pressure will be required to force the steel shaft into place, as represented in the accompanying sketch, the holes being bored so as to make a



tight fit? *A.*—A tight fit is an indefinite expression. The amount of the hole is smaller than the shaft, the quality of the metal, and the smoothness of the boring and turning, will all influence the pressure required. With smooth boring and turning, a pressure of fifteen to twenty tons will make a good fit.

(400) A. L., Helleforsnas, Sweden, writes: We are making sadirons, and get about ten per cent. bad castings, caused by holes appearing on the face after they are ground. These holes, I think, come from the core. Can we make the core so that no trouble will come from it? *A.*—An experienced moulder offers the following as a remedy "The irons should be cast face down. Make the core of open material, using ten per cent. of fine sawdust, with one to twenty of flour. Take boiled linseed oil cut with alcohol, to make it thin, and moisten the core with it while green—before baking. If a smooth hole is required, put one to ten of sea coal in sand when mixing. Give good vent and there will be no trouble from the core. I think his cores get damp, being small and standing some time, before pouring. The boiled linseed oil will prevent that, and make the core hard, and the iron will lay against it quietly. The iron should be hot, and an 8" head used."

(401) C. K., Toronto, Canada, writes: I have a Richardson "pop" safety valve that leaked, and I have repaired it, making it tight; but now, when it blows off, it reduces the pressure too much. What can I do to make the valve close, after reducing the pressure about five pounds? *A.*—The amount the valve will reduce the press-

ure is principally dependent on the distance the outer lip of the valve projects below the head of the bushing or seat, and the extent of the opening between the inside surface of the lip and the head. In refitting the valve, you have let the lip down lower than it was, and diminished the opening, either of which will cause the valve to reduce the pressure more before closing. If you have one of these valves as at present constructed, by screwing up the screwed ring that forms the head of the valve, you will, provided you have not got the parts out of truth in refitting, be able to make it blow down as little as you desire. If you have one of the old style, this can only be done by cutting a little off the lip, and increasing the opening referred to. If you attempt this, you will have to work very carefully, or you will go too far.

(402) A. B., Ottumwa, Iowa, asks: What distance should the grate bars be from the shell of a boiler 48″ diameter to give the best results with bituminous coal? *A.*—There is much difference in the practice of different engineers in this respect. We should make the distance 36″

(403) M. S., Buffalo, N. Y., asks: Please tell me what would be the best metal to use for a box for a shaft slightly loaded, but running at high speed under water, with no other lubricant? *A.*—We think you will find bronze as good as anything. Both bronze and babbitt boxes are frequently used with water for a lubricant. Lignum vitæ would perhaps be better than any metal.

(404) G. A. H., Decatur, Ind., writes: I have trouble in drilling Bessemer steel castings. I make the drills of the best steel, but they will not stand to drill but a short distance. Can you help me in the matter? *A.*—Bessemer steel castings are generally hard to drill, but we have always succeeded in drilling them by making a drill rather blunt, with moderate clearance on the cutting edges, and leaving very hard, starting the temper but a trifle after hardening, and that very slowly. Some machinists claim to be able to drill very hard material by using mercury instead of water for cooling, in hardening. We think, however, if you forge carefully, leaving the drill as previously mentioned, and run it slow, you will be able to drill the castings. You cannot expect to drill very rapidly.

(405) C. H. M., Philadelphia, Pa., writes: 1. I have made and used a telephone line, in a building, which works very nicely. In this line the wire runs direct. In another line I have made, the wire runs around angles, and this line does not work well. I think the trouble is in the contact at the angles. Can you suggest a remedy? *A.*—We can suggest nothing, except insulating the wire, allowing it to come in contact with nothing but glass. 2. I am running a 7″x9″ upright engine, at 150 revolutions per minute; boiler pressure 60 lbs. I use a governor, which is very sensitive, but the engine is overloaded, and consequently cannot run regular. The steam pipe is 10 feet long, 1½″ diameter. Will it be an improvement to increase the pipe from the governor to the boiler to 2″, or should I use a larger governor, and increase all the pipe? *A.*—If you use larger pipe, you should use larger governor as well. If the ports in cylinder are ample, the best remedy would be to use 2″ pipe and governor, and increase the speed of the engine.

(406) W. S. H., Morgantown, W. Va., writes: A friend of mine is running a plunger pump. The heater stands two feet higher than the top of pump, the pipe from the heater to pump being one inch diameter, eighteen feet long, and has three right-angle bends. The discharge pipe is one inch diameter, five feet long, with two right-angle bends. The suction valve hammers; and I claim, if the suction pipe was larger and the bends easier, the valve would not clatter so much. I think a 1¼″ pipe should be used. Am I right? *A.*—You should have given the size and stroke of plunger, and the speed at which it runs. In pumping hot water, difficulty with noisy valves is frequently experienced. It is always advisable to use a large suction pipe. The suction valve of pump should also be large, so as to require but little lift. Sometimes a light spring on the suction valve will steady it. On general principles, it is probable that increasing the suction pipe to 1¼″ or 1½″ will be beneficial; but not knowing the dimensions and speed of pump, we cannot say.

(407) M. D. B., Litchfield, Conn, writes: I am twenty-two years old, and have a good common school education, having studied algebra and geometry. I have always lived on a farm, and consequently know nothing, except what I have read, of the machinist's trade. I wish to become a mechanical engineer, but not being able to take the course in a technical school, I have decided to learn the machinist's trade, and while doing it to study drawing, mathematics, and mechanics. I want to make a specialty of steam engineering, particularly of the locomotive. Can I learn in a steam-engine shop to do all kinds of machine work, or can I learn in a general machine shop all about engine work? Please advise me what kind of a shop to enter. *A.*—You can learn to do machine work in any respectable machine shop, and you can apply that knowledge to the building of steam engines or any other machines. Since, however, you are desirous of studying the steam engine, we should advise that you enter a shop where that kind of work is done, at least in part, as the connection will be of benefit to you in your studies. You are well circumstanced, so far as school education is concerned, and there is nothing in the way of your succeeding in almost any shop.

(408) E. T., Philadelphia, asks: 1. How can I compute the power of a square threaded screw? *A.*—To find the pressure exerted by the screw, multiply twice the length of the lever by 3.1416, and this product by the force applied at the end of the lever. This, divided by the pitch of the screw, will give the pressure exerted, except what is lost in friction. Example: Length of lever, 12″: force applied, 10 lbs.; pitch of screw, 1″.

$$\frac{24\times3.1416\times10}{1}=753+.$$

the pressure in pounds exerted by the screw. 2. How can I ascertain the pressure in the cylinder of an engine, near enough for practical purposes, without the use of an indicator? *A.*—You cannot ascertain the pressure without the use of an indicator. 3. If it takes 60 lbs. pressure, by gauge, to run an engine non-condensing, how much will it require with a condenser? *A.*—This will depend upon the construction of the engine. Probably about 50 lbs.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Models & Mach'y—G. D. Lambert, New Haven, Ct.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

"Tack Machinery"
Willets Manufacturing Co., Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 144 LaSalle st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York; Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Slide Valve Working Models. Send for circular. See notice in this paper, October 13, page 9. E. E. Roberts, 107 Liberty Street, N. Y.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

The "Wax Process" engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Corliss Steam Engines at a bargain. One 12″x42″; one 16″x36″; one 20″x42″. All in first-class running order. Henry I. Snell, 135 N. 3d Street, Philadelphia, Pa.

"Recent Locomotives."
Specifications and large-scale engravings, with details, of 70 present types of locomotives, $5. For sale by the Railroad Gazette, 73 Broadway, New York.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880. A limited number for sale at $3.50 per volume, express charges to be paid by purchaser. $4.50 per volume will be charged for 1881 and 1882. AMERICAN MACH. Pub. Co., 96 Fulton st., New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information; will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

EXTRACTS FROM CHORDAL'S LETTERS, containing nearly 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with additional illustrations, many of them humorous and all effective—over 50 in all. Just the thing for a holiday or birthday gift. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES.

A new iron and nail works is being built at Lynchburg, Va.

A round-house and repair shop will at once be built at Willis, Texas.

A brick building, 80x152, is being erected for the wire-nail mill at Beaver Falls, Pa.

Thomas Broughton, of Taunton, Mass., is building a file factory in Brockton.

The new nail mill at Bay View, Wis., is expected to be in operation by January 15.

The Cambria (Pa.) Iron Company have notified their men of a proposed reduction of 10 per cent.

The new plant of the Pullman Iron and Steel Company, at Pullman, Ill., is about completed.

The Joliet (Ill.) Rolling Mill will be closed December 15. Lack of orders is supposed to be the cause.

Albert Smith & Son, 445 Eleventh avenue, New York, are about to erect a new boiler shop, 45x100 feet.

The Charter Iron and Steel Company (limited), at Mansfield, Pa., are about to build a new rolling mill.

The Scientific Mill and Forge Company, Springfield, O., have been reorganized, with a paid-up capital of $30,000.

The Baragwanath steam-jacket feed-water heater was awarded the first prize at the Southern Exposition, at Louisville.

The Shenango, Pa., Machine Company, Sharon, will soon have their new works in operation. The machinery is being put in position already.

Kendall & Roberts, engine and boiler builders, Cambridgeport, Mass., have reduced their hours of labor to nine, with no reduction in pay.

D. H. McAlpin & Co., 10th street and Avenue D, New York, are about to put in two tubular boilers, 120 horse-power each, built by Quintard Iron Works.

The Hayden Company, at Haydenville, Mass., are building an iron foundry in their mill yards, about fifty feet square, and will do their own casting in the future.

Work has been commenced on the new Howe Machine Company's factory in Bridgeport, Conn., and it is expected that the three-story brick walls will be finished in January.

The new Howe Sewing Machine factory, at Bridgeport, Conn., will be 150 feet long and three stories high, and is to be finished by January 1. The company can then work 500 to 700 hands.

The Nashua (N. H.) Co-operative Foundry Company have recently purchased the tools, together with the land and buildings now occupied by them, and formerly known as the Otterson Foundry.

Another industry will soon be added to Wallingford, Conn.—the Sweetland Chuck Company. The capital stock of the company will be $45,000, of which Wallingford citizens subscribe $15,000.

The car shops of the Air-Line and New Albany and Chicago Railroads will be built at Monon, Ind., the terminus of each division. The ground has been purchased, and timbers are being put upon the ground.

Several Pennsylvania iron and steel manufacturers have reduced the wages of their employes ten per cent. Of course purchasers of iron and steel will now expect to obtain their supplies for less money than before.

A number of leading capitalists of Cincinnati propose to organize a stock company, with $500,000 capital, to establish in that city a mammoth cotton-mill, with a capacity of 1,000 looms, for the manufacture of sheetings and muslins.

The Lehigh Car Manufacturing Company, at Stemton, Pa., are building ten cars of improved construction, for the transportation of horses. They are fitted up with stalls for fifteen horses each, with conveniences for feeding and watering, and are virtually stables on wheels.

The site for the tin-plate mill, and the $10,000 bonus pledged by the citizens of Hubbard, O., have been secured, and the contract between Messrs. Hutchings and Frick and the New York capitalists has been signed for the erection of the long-talked-of tin-plate mill at Hubbard.

Glenwood, a suburb of Pittsburgh, Pa., is soon to have twelve acres of railroad shops. A large portion of the material from the Centennial buildings has been purchased by the B. & O. Company and shipped to Glenwood, and will be used in the new improvements.

Lodge, Barker & Co., Cincinnati, O., manufacturers of the valve milling machine illustrated in this issue, also other iron and brass workers' tools, have appointed the following agents for the sale of their productions: H. Prentiss & Co., 42 Dey street, New York; J. A. Fay & Co., Chicago, Ill., and H. P. Gregory & Co., San Francisco, Cal.

J. S. Rosenthal and P. A. Seeger, of Baltimore, have made a heavy purchase of marble lands in Pickens county, Ala. They propose to incorporate a company with a capital of $100,000, and will buy machinery and put it in operation as soon as possible. They report that from $50,000 to $75,000 will be put into the necessary machinery, &c., for quarrying. They also expect to establish a factory for making slate and marble mantels, &c.—*Baltimore Manufacturers' Record.*

The Henry R. Worthington Hydraulic Works, 86 and 88 Liberty street, New York (branch offices in Boston, Chicago, St. Louis, and San Francisco), have issued a new illustrated catalogue and price list of their pumping engines, steam pumps, and hydraulic machinery. The prices are those of August 1, 1883. The pages are smaller than those of their former catalogue, the engravings being reduced.

The De La Vergne Refrigerating Machine Company, of 157 Bank street, New York, have issued a new, neatly-printed and bound catalogue of their refrigerating machinery. It is profusely illustrated by the "artotype" process, which, although inferior to good wood engraving, correctly represents the apparatus used in different breweries. The explanations are copious and clear.

The St. Louis *Age of Steel* says: Business at local machine shops continues to slowly improve, there being relatively more activity at the smaller establishments than the large ones, owing to the fact that a large proportion of the orders is for job work. With machinery dealers there is a moderately-good demand for iron and wood-working machinery and saw-mill supplies, the season considered. Manufacturers of agricultural implements report a good demand for hay presses, feed cutters, corn grinders, &c, and are very busy on orders for this class of machines.

Mr. Toothe, of the firm of Nathan & Dreyfus, has just returned from an extended Western trip. He reports business as being quite active. There is a growing demand for their injectors and other brass supplies, especially for railroad use. Their patent boiler washer, which is a kind of steam siphon adapted for forcing a heavy stream of water into boilers, for cleaning them out, is gaining in popularity. The Union Pacific Railroad has ordered six of these boiler washers, and the Northern Pacific Railroad calls for twelve of them.

Although general business is somewhat dull in Pittsburgh, Pa., at present, two new enterprises are being pushed forward. Mr. Muttalath, a prominent member of the Trunk Line Company, is arranging with leading Pittsburgh capitalists to form a company to ship all the oil from the independent refiners to Southern markets. The scheme is meeting with satisfactory support. A new manufacturing firm, called the Standard Underground Cable Company, has been formed. They have purchased property, and will at once commence the erection of a building 100x170 feet, in which to manufacture the underground cable they intend to deal in.

The Pennsylvania Steel Company's descriptive catalogue of railroad switches and frogs, railroad switch stands, &c, interlocking switch and signal apparatus, and improved safety appliances, is a handsomely arranged catalogue, and it contains a great deal of information which is valuable to railroad men having a desire to learn about the safety appliances, which in the near future must be used in many crowded stations. Our railroad men, as a rule, are entirely unacquainted with what a system of interlocking switches means, and in many cases this prevailing ignorance delays the adoption of such appliances in places where they are already badly needed. Any one who will get this catalogue and read it over carefully, will certainly receive enlightenment about numerous railroad devices that ought to be better understood than they now are. In addition to an exhaustive description of switches and signals, the catalogue gives interesting information about the Bessemer and open hearth process of steel making. There is useful information to railroad men about the number of tons of rails required per mile of certain weights; the number of joint fastenings per prevailing length of rails; number of ties, spikes, &c., all of which will be found convenient. The catalogue was prepared by Mr. George W. Parsons, superintendent of the switch and signal department of the works at Steelton, Pa., and reflects great credit on his literary ability.

The Babcock & Wilcox Company report the following sales of boilers during the four weeks ending November 24th:

New York Steam Company, New York	1,250	H. P.
Ponemah Mills, Taftville, Conn	300	"
Maitland, Phelps & Co., New York (for export)	104	"
Arbuckle & Co., Brooklyn, N. Y.	308	"
Nathan R. Yewdall, Philadelphia, Pa.	104	"
McCracken, Stark & Co., " "	35	"
Dager & Cox, Bridgeport, Pa	104	"
Edison Electric Illuminating Company, Tiffin, O.	92	"
Edison Electric Illuminating Company, Mt. Carmel, Pa.	51	"
Edison Electric Illuminating Company, Newburgh, N. Y.	146	"
Edison Electric Illuminating Company, Hazleton, Pa.	92	"
Edison Electric Illuminating Company, Bellefonte, Pa.	82	"
William Lea & Sons, Wilmington, Del.	125	"
McCullough Iron Co., Northeast, Md.	104	"
W. W. Taylor, Havre-de-Grace, Md.	20	"
Westinghouse Air-Brake Company, Pittsburgh, Pa.	92	"
Lucy Furnaces, Pittsburgh, Pa.	832	"
Pittsburgh Steel Casting Company, Pittsburgh, Pa.	416	"
Black & Germer, Erie, Pa.	92	"
Total	4,149	"

The New York Steam Company has now ordered 8,999 horse-power of these boilers. The various Edison companies, including those in the United States, London, Paris, Milan (Italy), have ordered 3,356 horse-power.

The stockholders of the Scranton, Pa., Steel Company have unanimously agreed to increase their capital from $600,000 to $1,500,000, for the purpose of building a new blast furnace. If the increase represents actual cash, it is to be hoped they will have a few cents left over after building the furnace.

Machinists' Supplies and Iron.

NEW YORK, December 6, 1883.

The general supply business is not entirely satisfactory.

In American pig iron the market is quiet and steady, with slightly better feeling as to future prospects. We quote No. 1 X Foundry at $20 to $21; No. 2 X, $19 to $19.50.

In Scotch pig the transactions are limited, with Coltness, $22.50; Glengarnock, $21 50; Gartsherrie, $23; Summerlee, $22.50; Eglinton, $20 to $20.50.

Antimony holds the advance at—Hallett's 10¼c. to 10½c.; Cookson's, 10¾c.

Copper is dull, with sales of Lake, at 14⅞c. to 15c.; other brands, 14c. to 14⅛c.

Lead rules dull, with sales of common pig at 3.65c

Spelter—Refined, 8c. to 8¾c.

Tin—Banca, 21½c.; Straits and Malacca, 19c. to 19¼c.

Boiler plate is weak, with sales of Tank at 2 4-10c. to 2 5¾c.; refined, 2¾c. to 2 9-10c.; shell, 3c. to3¼c.; flange, 4c. to 4¼c.; extra flange and fire box, 4½c. to 5c.; open hearth steel, 5¼c. to 5¾c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Situation as superintendent or engineer. Reference given. Address, A.B., care AM. MACHINIST.

Wanted—By a machinist, situation as foreman or superintendent. Best of testimonials as to character and ability. Box 428, Fitchburg, Mass.

Wanted—A capable, energetic mechanic, as foreman for a heavy machine shop. Address Williamson & Barker, 68 Washington street, Chicago, Ill.

Engineer who can make his own repairs, &c., wishes situation; city or country. A 1 references. Address Engineer, Station D, Jersey City, N. J.

First-class mechanical draughtsman, graduate; of long experience; able to construct any kind of machinery and superintend building of same, desires situation. Address E. H., AM. MACHINIST.

Wanted—Situation as foundry foreman, by one having 14 years' experience in that capacity. Familiar with all branches of the trade. Best of references given. Address BOX 9, AM. MACHINIST.

Wanted—A situation, by a mechanical draughtsman; has had a good general experience, and can handle men to the best advantage. Address Square, AMERICAN MACHINIST.

Situation Wanted—By a man of experience in steam engine and general jobbing work. Expectations not less than $1,200 a year, or might put skill against capital. Correspondence solicited. Address F. J. Masten, Pullman, Ill.

Wanted—A situation as foreman, by a pattern maker of 20 years' experience. Well acquainted with all classes of foundry work: is a good draughtsman, and accustomed to handle men Best references Address Experience, AMERICAN MACHINIST.

A first-class mechanical engineer and draughtsman, with 20 years' experience in the designing and building of automatic engines, boilers and general machinery; and as manager and superintendent, is open to an engagement. Best of references. Address—R 42, AMERICAN MACHINIST.

Draughtsmen—Wanted, several first-class men to work, under direction, on designing new machinery of a high class. Engineering knowledge is essential, and should, if possible, include training both in theory and practice. Address, stating age, references, past experience and compensation expected, W. E. Y., BOX 4, AMERICAN MACHINIST.

Wanted at once—Two first class experienced mechanical draughtsmen. Experience considered as first qualification. Foreigners who cannot talk and understand English will please not apply. Address, giving full particulars, as to years of practice, character of work done, wages expected, &c., Brown & Sharpe Mfg. Co., Providence, R. I.

To English Workmen.—A competent man wanted to return to Manchester to take charge of a department making Medart Patent Pulleys. It will be necessary for the workman selected to remain a month at the works in St. Louis, carefully studying the processes of manufacture. Expenses to and while at St. Louis only will be paid. Address by letter only. Medart Patent Pulley Co., 1,206 N. Main st., St. Louis, Mo.

Wanted.—Good second-hand boiler maker's Punch, shears and rollers. Give lowest cash price, and full description. Sulzer & Vogt, Louisville, Ky.

Wanted Immediately—First-class machinist, with some capital. Best chance of all. Address at once for particulars, T. W. Wisner, Caro, Tuscola Co., Mich.

Wanted to Purchase—Screw-cutting foot-power lathe, from 8 to 10 inches swing, bed about 36 inches long. Must be of decidedly first-class workmanship. State price and particulars. G. B., AM. MACHINIST.

Wanted, machinery to build—Parties having machine, blacksmith, and bolt shops combined, are desirous of more work Estimates furnished for all kinds of work. Special prices to responsible parties. Address B. B. B., AMER. MACHINIST, New York.

New Tacoma Iron Works

FOR SALE.

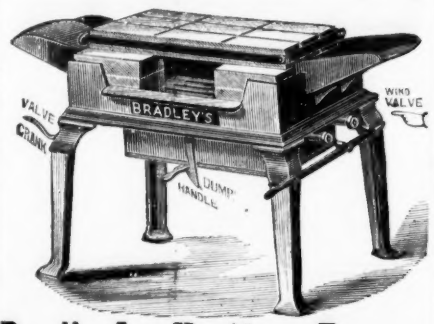
The Machine Shop, Foundry, Boiler Shop, Blacksmith Shop, Brass Foundry, with all Fixtures, Tools and Machinery.

One of the most extensive and complete establishments on the Pacific Coast, now in successful operation and employing about ONE HUNDRED MEN, is offered for sale at a bargain. The grounds are ample in extent, and the location unsurpassed.

Impaired health of the senior partner is the cause for selling.

If desired the Tools, Machinery, &c., will be sold and the Real Estate leased.

Address:—
LISTER, HOUGHTON & CO.,
New Tacoma, Wash. Ter.



Bradley's Heating Forges,

FOR HARD COAL OR COKE,
BRADLEY & CO., - Syracuse, N. Y.

WORKSHOP RECEIPTS.

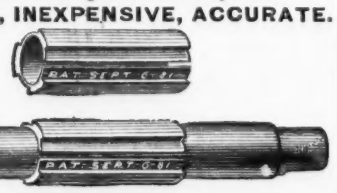
For the use of Manufacturers, Mechanics and Scientific Amateurs. First and Second Series, each containing about 450 pages, with illustrations. PRICE $2.00 per volume. Descriptive circular and catalogue of books for mechanical engineers sent free.

E. & F. N. SPON, 35 Murray St., N. Y.

UPRIGHT DRILLS.
CUTTING OFF TOOLS.
SATISFACTION.
STERLING ELLIOTT.
NEWTON.
MASS.
SPECIAL MACHINERY.

HORACE THURSTON, 84 Clifford St, Providence, R. I.
MANUFACTURER OF
FINE TOOLS & SPECIAL MACHINERY.
Jewelers' Rolls and Flattening Dies accurately ground and lapped. Index Drilling, Irregular-formed Cutters and Gauge Making, Bevel and Spur Gear Cutting, up to 6 dia. 4 pitch Fluting Taps, Reamers, and Plungers. Having put in a line of Brown & Sharpe Mfg. Co.'s tools, I am prepared to do work of a character not done in ordinary machine shops.

WILDE'S PATENT
Expanding Mandrel
is the most perfect novelty out.
SIMPLE, INEXPENSIVE, ACCURATE.



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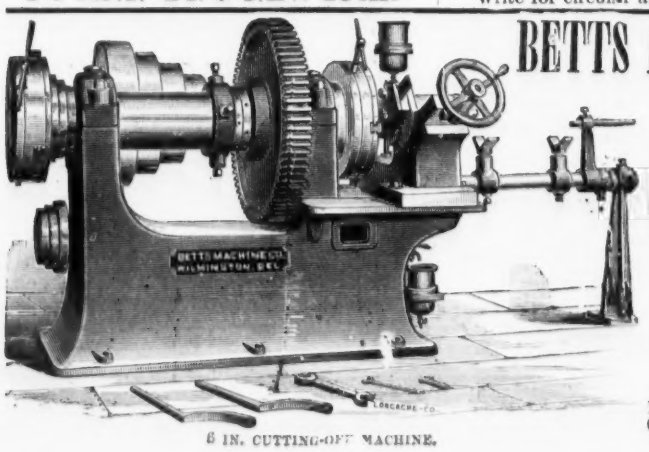
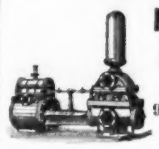
22 CORTLANDT STREET, N. Y.
Sales Agents and Dealers in General
MACHINERY AND SUPPLIES.
Write for circular and mention this paper.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. ✲ NEW YORK.



6 IN. CUTTING-OFF MACHINE.

BETTS MACHINE CO.
Wilmington, Del.,
MAKERS OF
MACHINE TOOLS
FROM
Improved Patterns.
Three sizes of Cutting-Off Machines: 2½ in., 4 in., and 6 in.



The Deane Steam Pump Co.,
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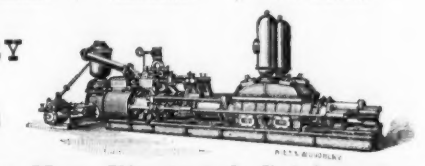

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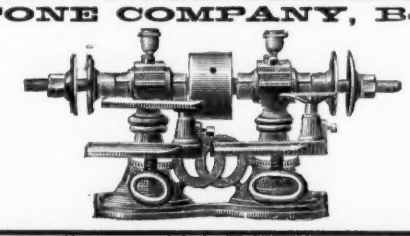

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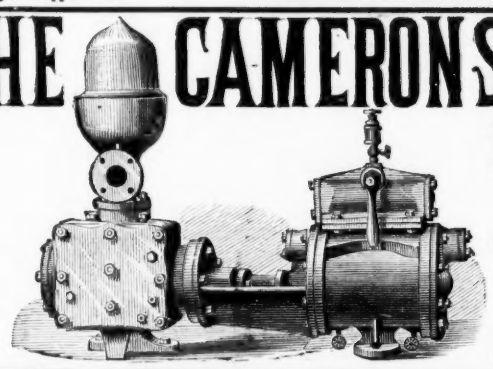

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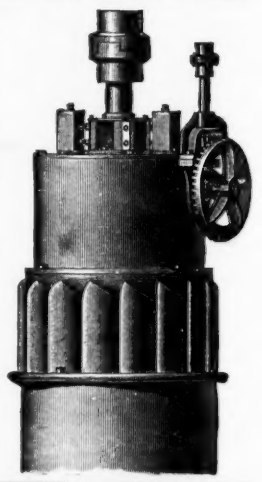

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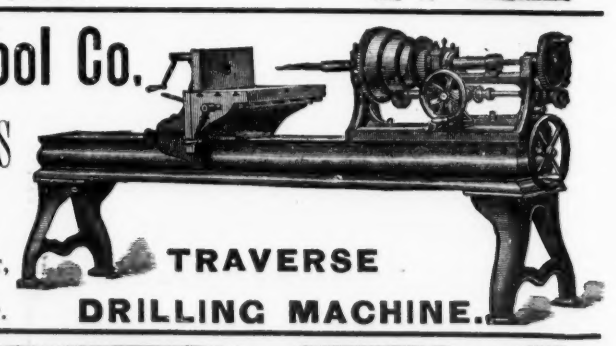

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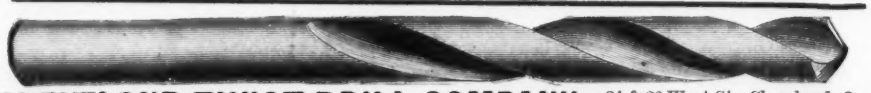

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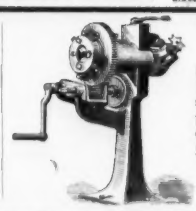

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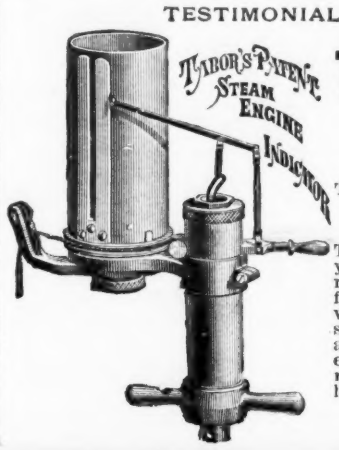

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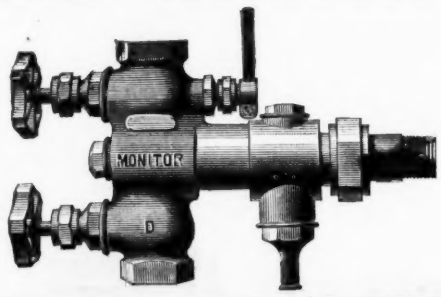

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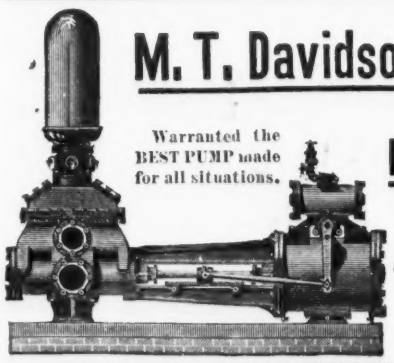

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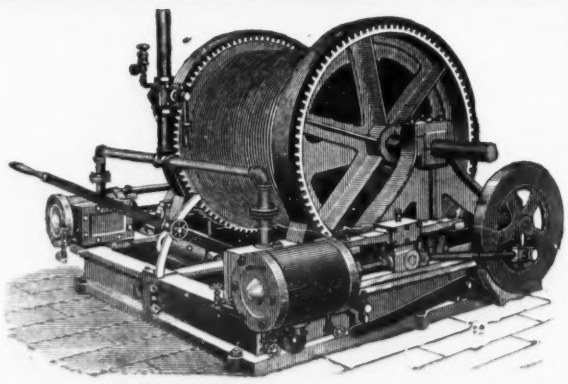

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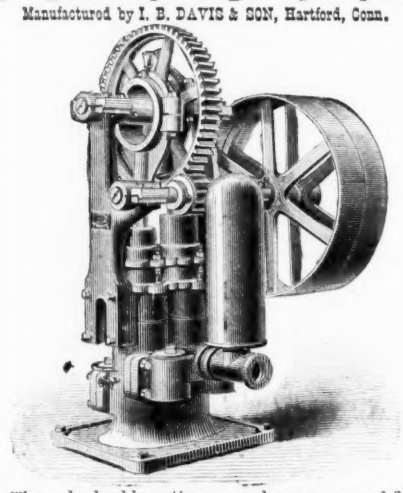

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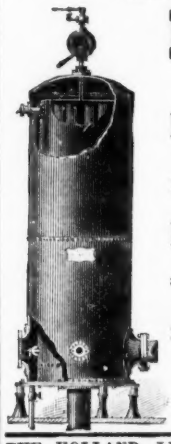

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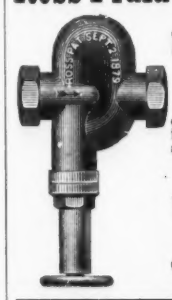

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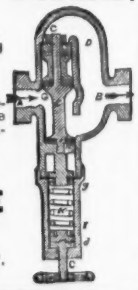

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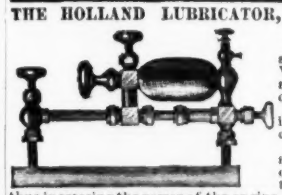

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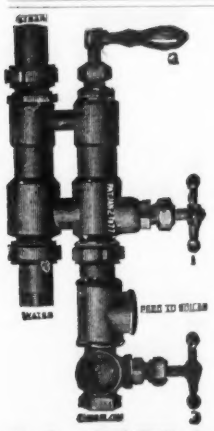

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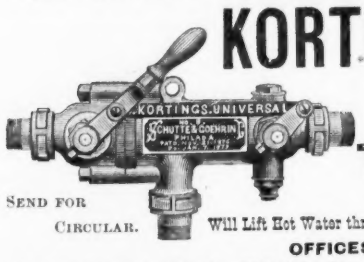

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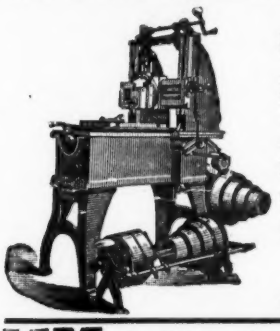

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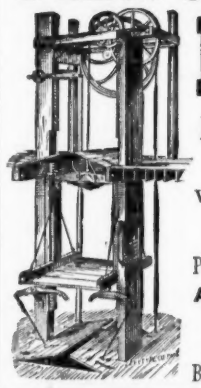

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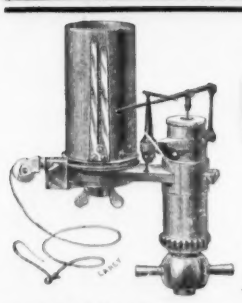

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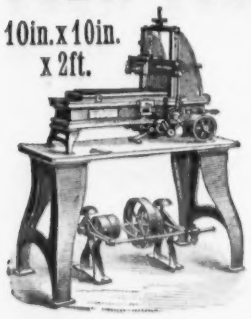

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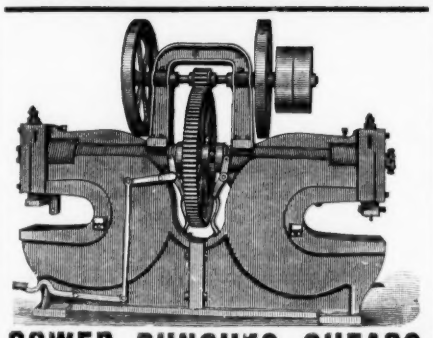

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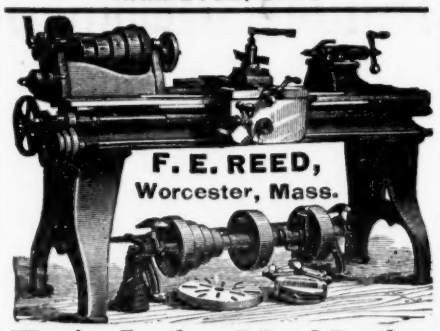

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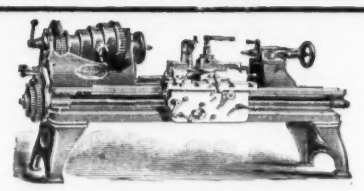

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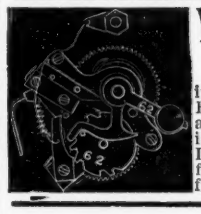

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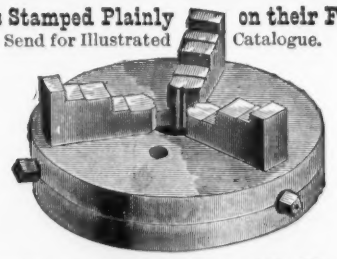

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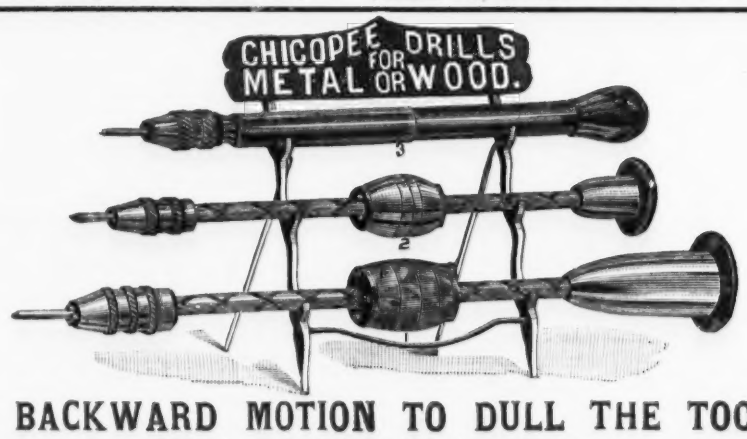

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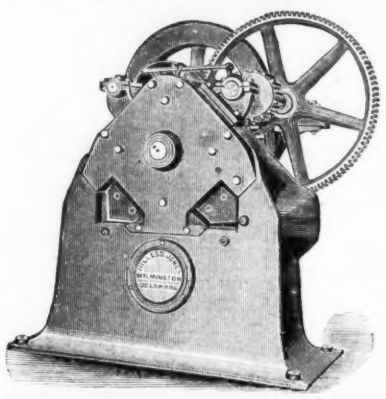

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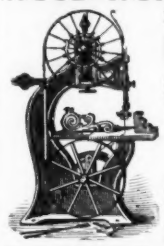

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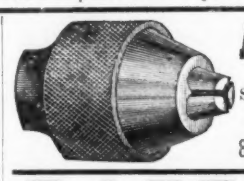

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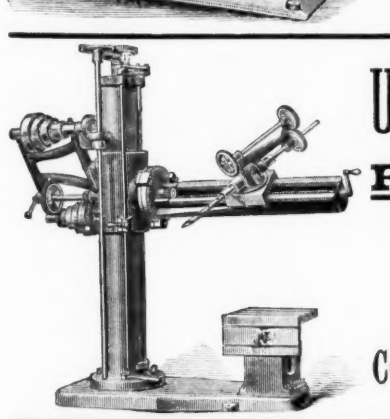

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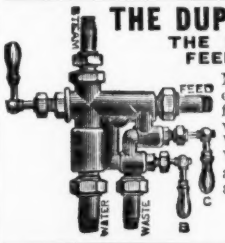

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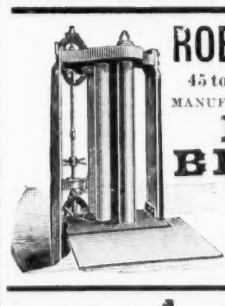

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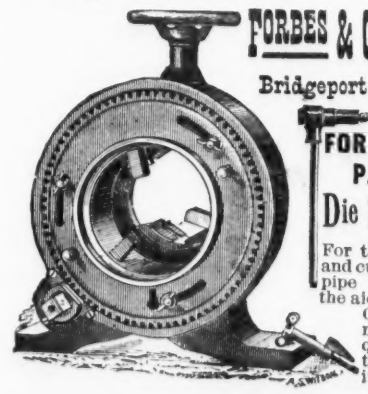

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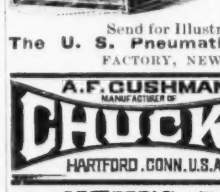

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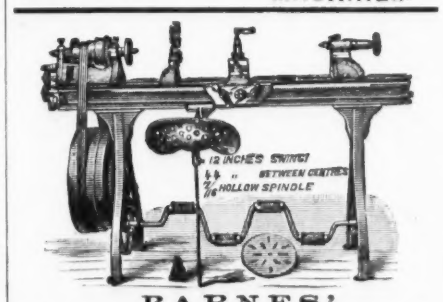

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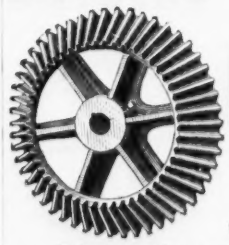

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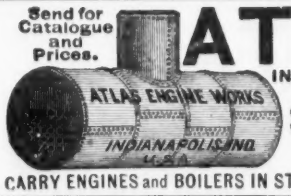

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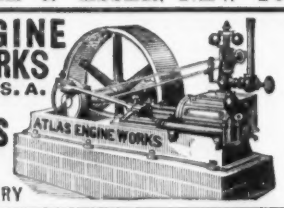

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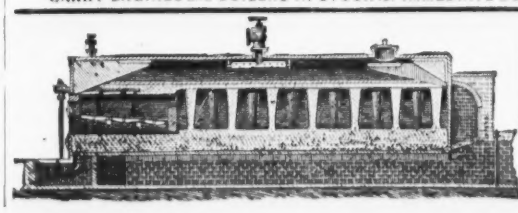

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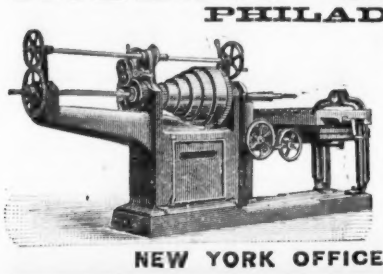

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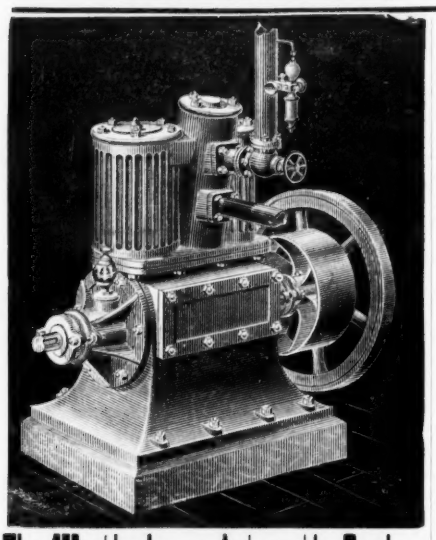

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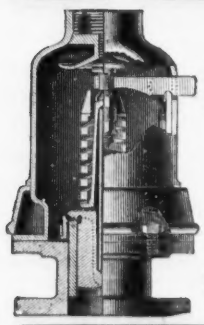

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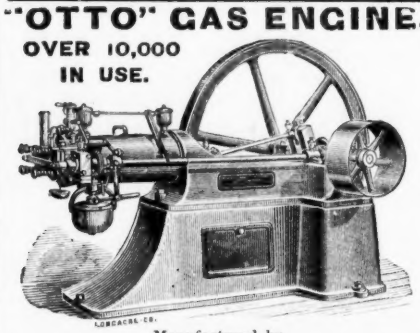

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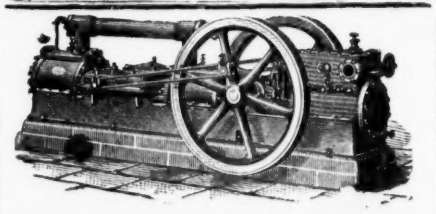

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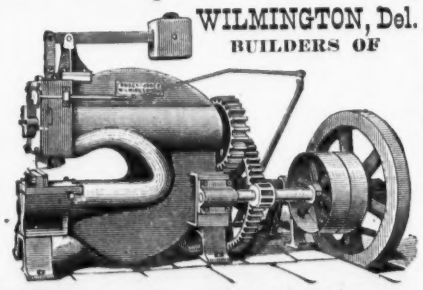

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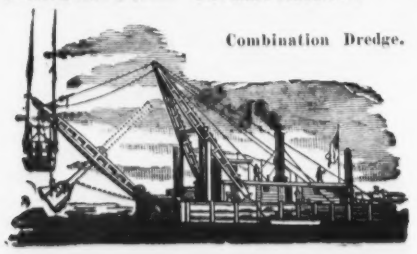

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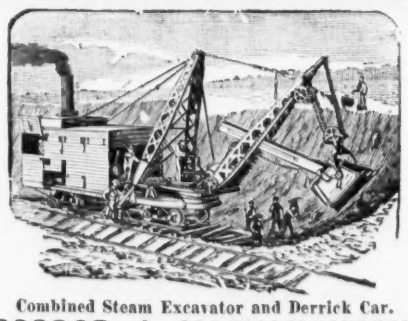

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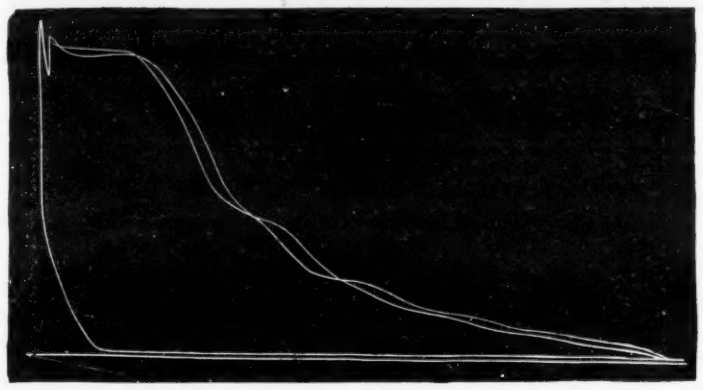

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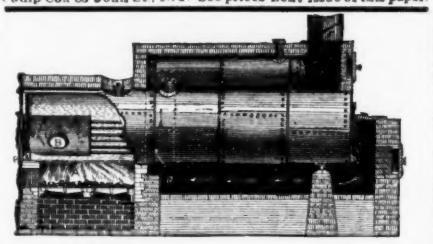

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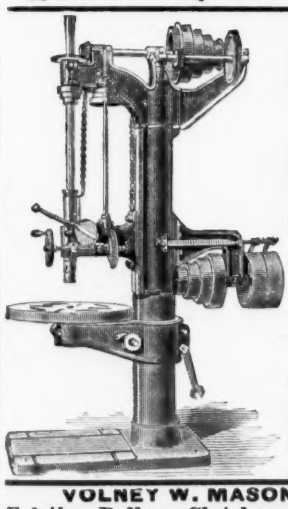

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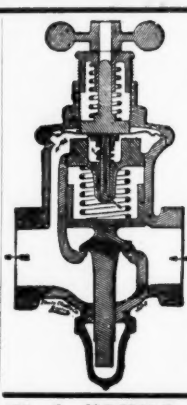

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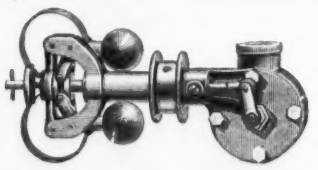

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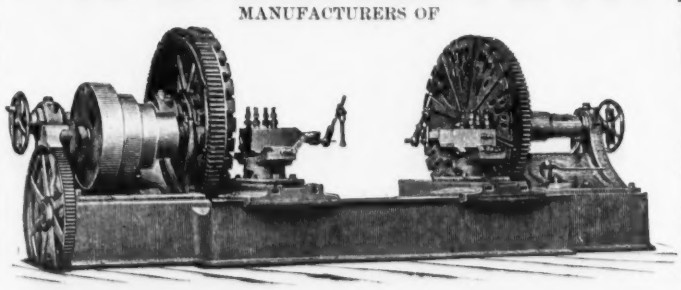

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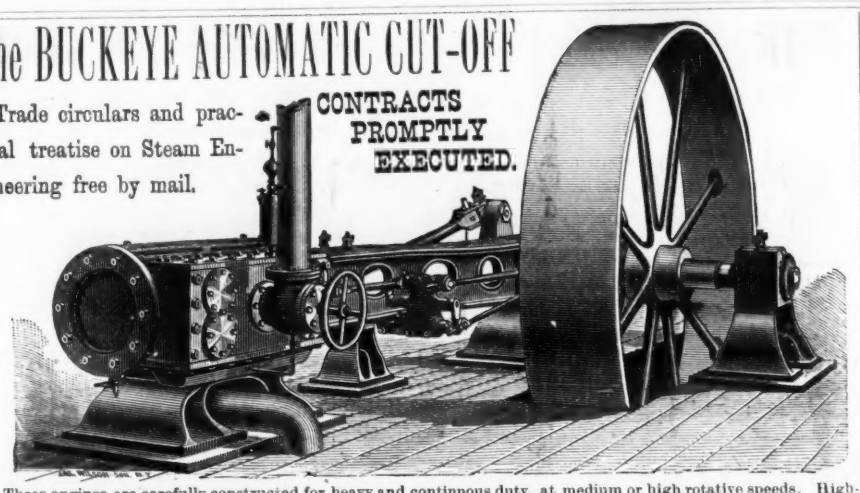

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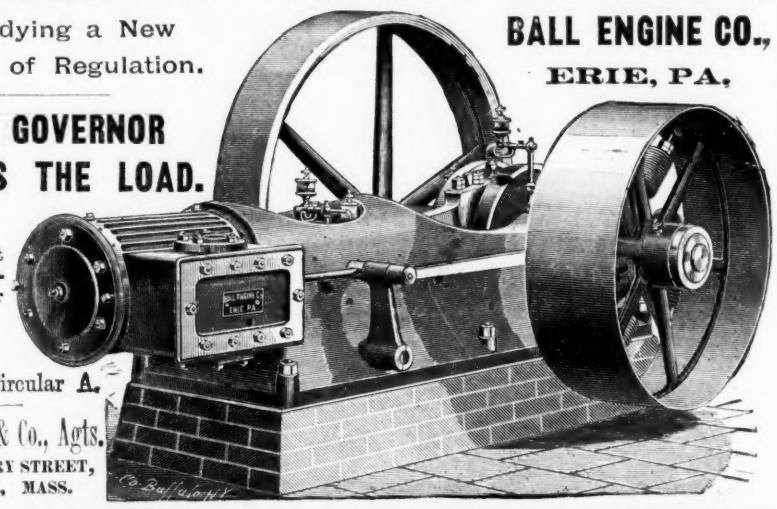

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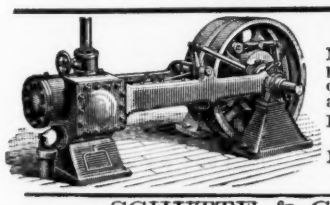

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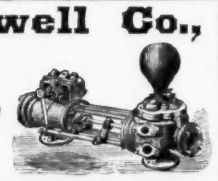

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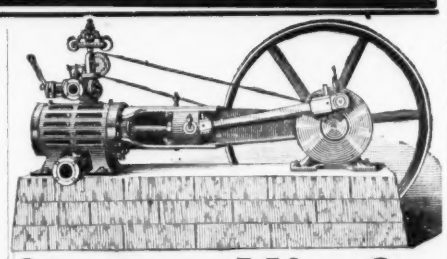

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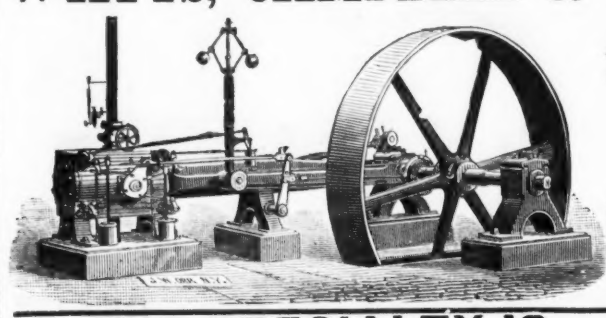

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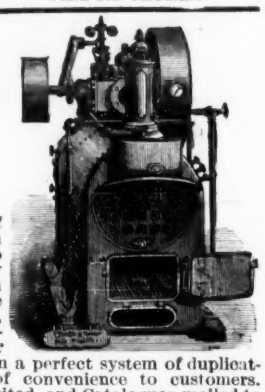

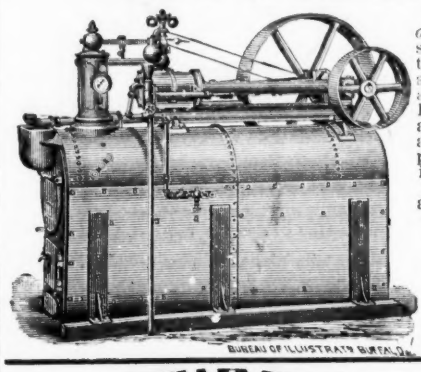

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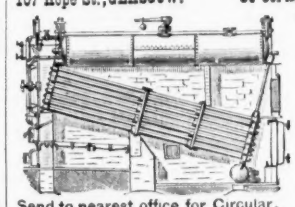

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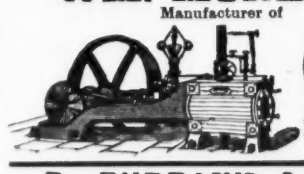

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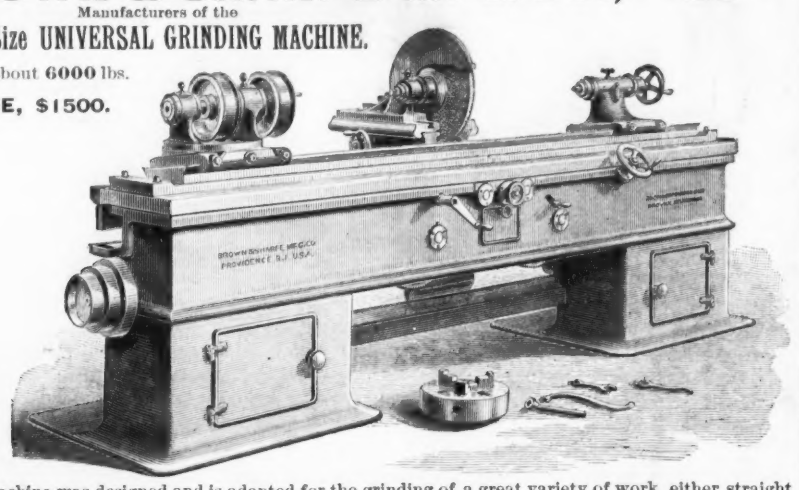

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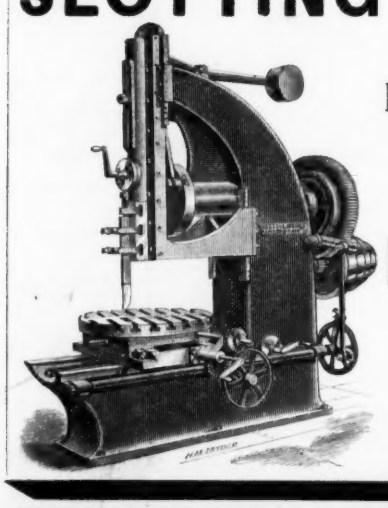

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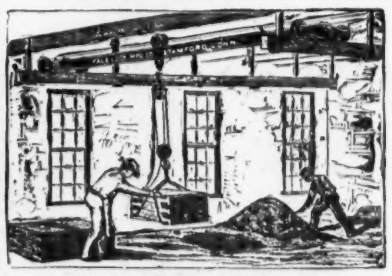

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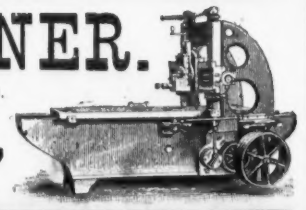

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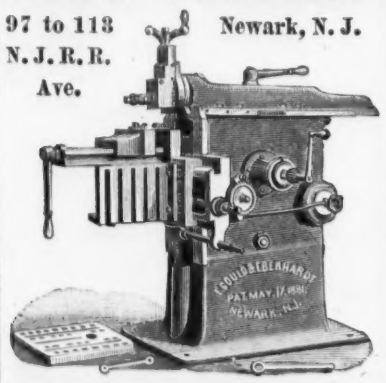

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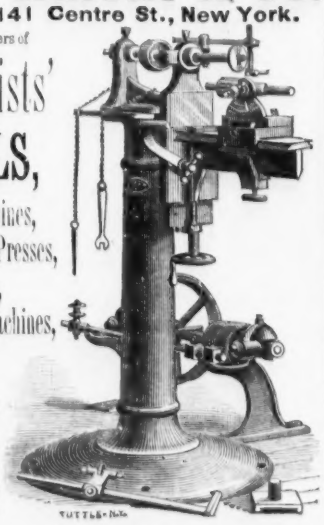

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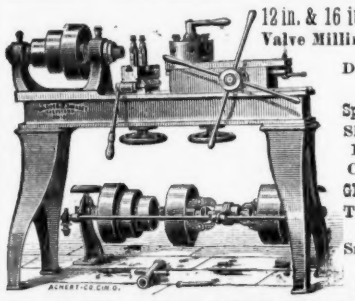

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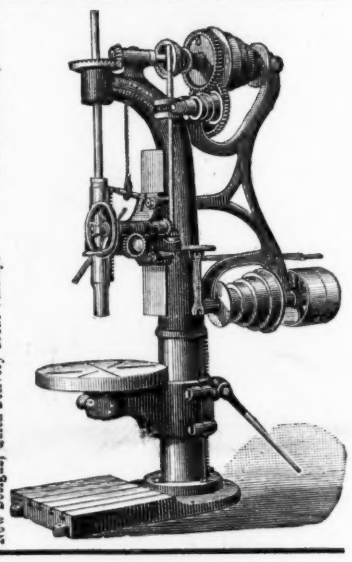

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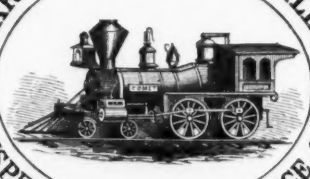

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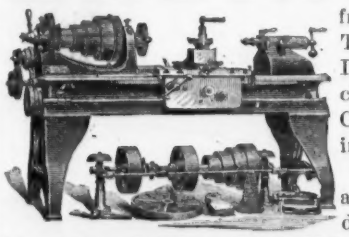

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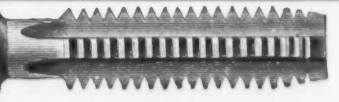

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